



WESTON SOLUTIONS, INC.
Suite 201
1090 King Georges Post Road
Edison, New Jersey 08837-3703
732-585-4400 • Fax: 732-225-7037
www.westonsolutions.com

The Trusted Integrator for Sustainable Solutions

REMOVAL SUPPORT TEAM 3
EPA CONTRACT EP-S2-14-01

August 4, 2015

Mr. Eric Daly, On-Scene Coordinator
U.S. Environmental Protection Agency
Response & Prevention Branch
2890 Woodbridge Avenue
Edison, NJ 08837

EPA CONTRACT NO: EP-S2-14-01

TDD NO: TO-0006-0064

DOCUMENT CONTROL NO: RST3-02-D-0031

**SUBJECT: SITE-SPECIFIC HEALTH AND SAFETY PLAN – HOLY TRINITY
CEMETERY SITE, LEWISTON, NIAGARA COUNTY, NEW YORK**

Dear Mr. Daly,

Enclosed please find the Site-Specific Health and Safety Plan (HASP) for the radiation assessment activities to be conducted at the Holy Trinity Cemetery Site beginning the week of August 10, 2015. As part of the assessment, radiation surveying and sampling will be conducted to identify the extent of radiation exposure. If you have any questions or comments, please do not hesitate to contact me at (732) 585-4421.

Sincerely,

Weston Solutions, Inc.

For Joel Petty
RST 3 Site Project Manager/Group Leader

Enclosure

cc: TDD File No.: TO-0006-0064

an employee-owned company

In association with Scientific and Environmental Associates, Inc.,
Environmental Compliance Consultants, Inc., Avatar Environmental, LLC,
On-Site Environmental, Inc., and Sovereign Consulting, Inc.



**REGION II RST 3 HEALTH AND SAFETY PLAN
EMERGENCY RESPONSE/REMOVAL ASSESSMENT/REMOVAL ACTION PLAN**

RST 3 TDD No.: TO-0006-0064

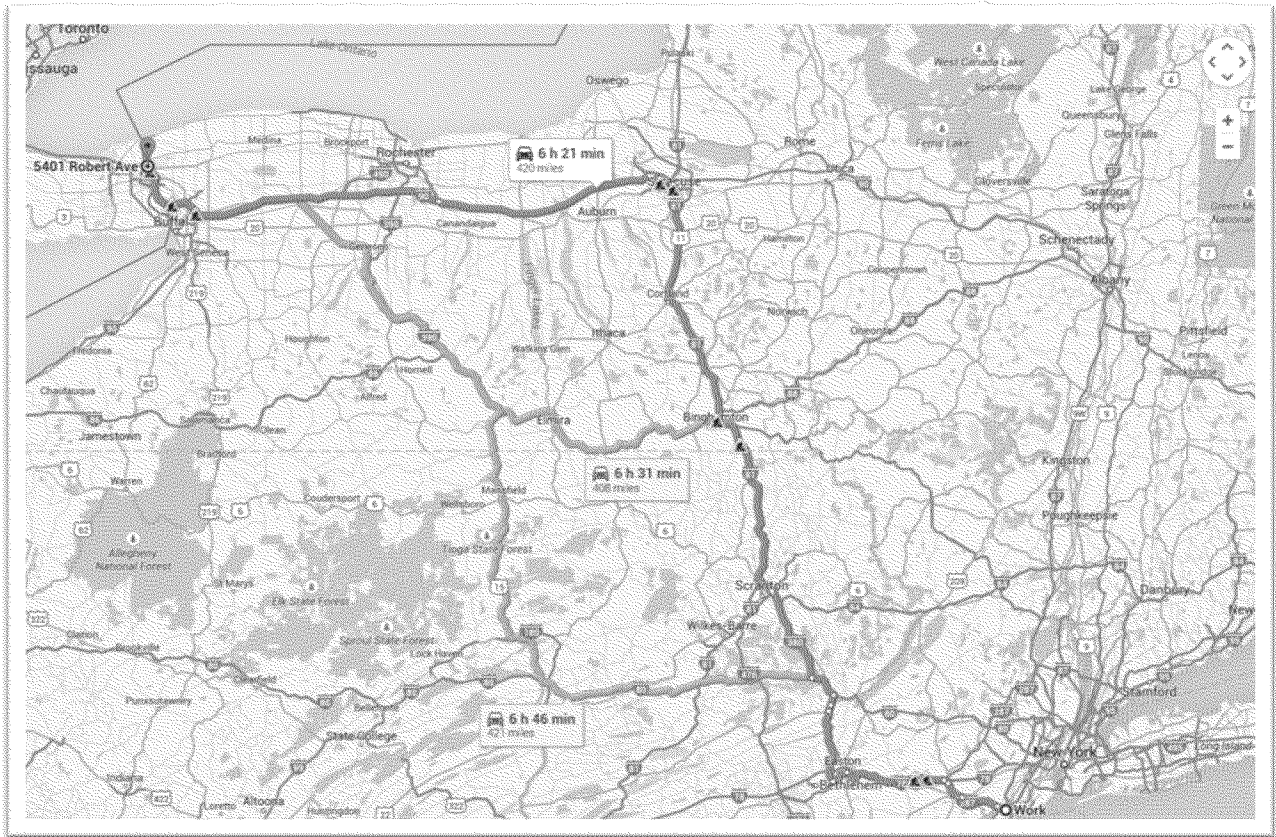
Site Name: Holy Trinity Cemetery Site

Site Address: Street: 5401 Robert Avenue
City/State: Lewiston, New York

Directions to Site: (Attach Color Map Following This Page)

1. Head **west** toward **King Georges Post Rd** 1.9 mi
2. Turn **left** onto **King Georges Post Rd** 289 ft
3. Turn **right** onto **Raritan Center Pkwy** 0.6 mi
4. Keep **right** at the fork, follow signs for **Middlesex County 514 E/Woodbridge Ave/I-287/NJ-440** and merge onto **Woodbridge Ave** 0.4 mi
5. Use the **right** lane to take the ramp onto **I-287 N** 0.8 mi
6. Merge onto **I-287 N** 2.1 mi
7. Keep **left** to stay on **I-287 N** 11.9 mi
8. Keep **right** to stay on **I-287 N** 6.3 mi
9. Use the **left** 2 lanes to take exit **21 B** toward **I-78 W/Easton PA** 1.5 mi
10. Merge onto **I-78 W** 31.0 mi
11. Keep **left** to stay on **I-78 W** 4.6 mi
12. Take exit **71** for **PA-33 N** toward **US-22/Stroudsburg** 0.4 mi
13. Continue onto **PA-33 N** 22.4 mi
14. Continue onto **PA-33 N/US-209 N** 2.0 mi
15. Keep **left** to continue on **PA-33 N/Hwy 33 N**, follow signs for **W Interstate 80 W/Bartonsville/Hazleton** 3.1 mi
16. Use the **left** lane to merge onto **I-80 W** toward **Hazleton** 9.0 mi
17. Keep **right** at the fork to continue on **I-380 N**, follow signs for **Scranton** 27.8 mi
18. Keep **right** to continue **I-380 N/I-84**, follow signs for **US-6 W/I-81 N/PA-347 Binghamton** 0.5 mi
19. Merge onto **I-81 N** 58.1 mi
20. Keep **right** at the fork to stay on **I-81 N**, follow signs for **I-88/Syracuse/Albany** 71.8 mi
21. Take the exit onto **I-690 W** toward **Fairgrounds/Baldwinsville** 7.7 mi
22. Keep **left** to stay on **I-690 W** 0.9 mi
23. Continue onto **NY-690 N** 0.2 mi
24. Take exit **1** to merge onto **I-90 W** 61.9 mi
25. Keep **left** to stay on **I-90 W** 69.0 mi
26. Take exit **50** for **I-290** toward **Niagara Falls** 0.4 mi
27. Continue on **I-290 W** 9.5 mi
28. Use the **right** 2 lanes to take the **Interstate 190 N** exit toward **Niagara Falls** 0.3 mi
29. Merge onto **I-190 N** 14.1 mi
30. Take exit **25 B** toward **NY-104/R. Moses Pkwy** 0.3 mi
31. Merge onto **Upper Mountain Rd** 0.3 mi
32. Use the **middle** lane to keep **left** at the fork and follow signs for **NY-104 W/R. Moses Pkwy** 0.1 mi
33. Keep **right**, follow signs for **New York 104 W/R. Moses N** 276 ft
34. Keep **right** and merge onto **NY-104 W** 0.3 mi
35. Turn **left** onto **Irving Dr** 0.3 mi
36. **Irving Dr** turns slightly **right** and becomes **Robert Ave; DESTINATION WILL BE ON RIGHT** 0.1 mi

Total Distance: 420 miles; Total Time: Approximately 6 hours, 21 minutes



*This map is subject to Google's Terms of Service, and Google is the owner of rights therein.
Portions of this image have been removed for clarity.*

Historical/Current Site Information:

The Holy Trinity Cemetery Site (the Site) [U.S. Environmental Protection Agency (EPA) ID No. NYN000206698] consists of an area of radionuclide contamination located at a cemetery which is approximately 31.5 acres in Lewiston, New York. The Site is owned by Holy Trinity Cemetery, which has 2.91 acres of observed contamination located in the northernmost portion of the property on a relatively flat and slightly elevated grassy field, as well as on existing roadbeds. There is one building on the Site which is utilized both as a residence and cemetery maintenance facility. The Site is bordered to the north and east by Interstate 190; to the south by another cemetery; and to the west by Robert Avenue and a residential area.

In a 1978 U.S. Department of Energy (DOE) aerial radiological survey, more than 15 properties throughout the region were identified as having elevated levels of radiation above background. It is believed that in the early 1960s slag from the local Union Carbide facility was used as fill on the properties prior to paving. The slag contained sufficient quantities of uranium and thorium to be classified as a licensable radioactive source material. Union Carbide subsequently obtained a license from the Atomic Energy Commission (AEC) [now the Nuclear Regulatory Commission (NRC)] and the State of New York; however, the slag had been used as fill throughout the Niagara Falls region prior to licensing. Based on the original survey and subsequent investigations, it is believed that the radioactive Union Carbide slag was deposited at the Site.

In February 1980, the New York State Department of Health (NYSDOH) Bureau of Radiological Health and the Niagara County Health Department conducted a radiological survey of the Site to

identify areas of elevated radioactivity as a result of radioactive slag having been used on the property for fill. The survey was conducted based on information that the slag used at the cemetery was from the same source used at two other locations in nearby Niagara Falls, which had been identified by the NYSDOH as containing elevated levels of radioactivity. During the survey, cemetery personnel showed NYSDOH a slag pile located near the caretaker's garage in the western portion of the property. Cemetery personnel stated that this slag was used as fill for the cemetery roads throughout the property.

Additionally, the slag was used as fill for the base of two proposed roadbeds that extended approximately 500 to 600 feet from the caretaker's garage, northwest toward Robert Avenue. At the time of the survey, the construction of these roads had been abandoned. The underlying slag base was covered with an unknown amount of soil and was left as an open field. Using an Eberline PRM 7 radiation meter, radioactivity of the slag pile was measured at 250 microroentgens per hour ($\mu\text{R/hr}$) and readings along cemetery roads ranged from 5 $\mu\text{R/hr}$ (*i.e.*, background concentration) to 30 $\mu\text{R/hr}$. Readings along the abandoned roadbeds ranged from 200 $\mu\text{R/hr}$ to 400 $\mu\text{R/hr}$. Samples of the slag were collected as part of the investigation. Laboratory analyses of the samples indicated detectable concentrations of potassium-40, uranium-235 and -238, radium-226, thorium-232, and one other isotope.

In October 2006, the New York State Department of Environmental Conservation (NYSDEC) and the Niagara County Health Department conducted a reconnaissance of the Site. At that time, the slag pile that previously had been observed near the caretaker's garage was no longer on the Site; the current caretaker had neither knowledge of the slag pile, nor what happened to it. The caretaker also indicated that children living nearby use this area for recreation. Since the 1980 NYSDOH site investigation, trees had grown through the abandoned slag roadbeds, pushing the slag to the surface. As part of the site visit, NYSDDEC conducted a radioactivity survey with an Exploranium GR-135. Readings taken while walking along the roadbed indicated levels of 200 $\mu\text{R/hr}$ to 450 $\mu\text{R/hr}$ at waist height and a surface contact reading of 450 $\mu\text{R/hr}$ to 570 $\mu\text{R/hr}$; a contact reading of 700 $\mu\text{R/hr}$ at exposed slag near a tree was also documented. NYSDDEC collected four samples of the slag which were analyzed for isotopic uranium and isotopic thorium, and underwent gamma-ray spectroscopy analysis. Laboratory analytical results indicated the presence of uranium-238/234 ranging from 114 picocuries per gram (pCi/g) to 1,664 pCi/g and thorium-232 ranging from 114 pCi/g to 898 pCi/g.

In May 2007, NYSDDEC visited the Site to identify contamination in an on-site debris pile using gamma-ray spectroscopy. During a 5-minute static reading, radium-226 was the only nuclide identified. A similar analysis was also conducted on one of the roadbeds confirming the presence of thorium-232.

During a reconnaissance performed by the NYSDOH and NYSDDEC in July 2013, screening activities at the Site along the roadway and along the back roadway leading off site showed radiation levels up to 51 $\mu\text{R/hr}$ in the roadway with the pressurized ion chamber (PIC) and up to 50,000 counts per minute (cpm) with the sodium iodide (NaI) 2x2 detector.

On December 12 and 13, 2013, Weston Solutions, Inc., Site Assessment Team (SAT) personnel collected a total of 14 subsurface soil samples and three slag samples from the Site. Soil samples were also collected from two locations suspected to be outside the influence of the area of observed contamination to document background conditions. At each sample location, soil samples were collected directly beneath slag material; at locations where a radioactive layer was not visually observed to be present, the soil sample was collected at the equivalent depth interval. The slag samples each consisted of one single piece of slag. The soil samples were analyzed by TestAmerica Laboratories for target analyte list (TAL) metals analysis; isotopic thorium, isotopic

uranium, radium-226, and radium-228 by alpha spectroscopy; and radioisotopes by gamma spectroscopy. The slag samples were analyzed for the same parameters, with the exception of TAL metals analysis. One soil sample for TAL metals analysis was designated as a matrix spike/matrix spike duplicate (MS/MSD) sample for quality assurance/quality control (QA/QC) purposes. One rinsate blank was collected to demonstrate adequate decontamination of non-dedicated sampling equipment (*i.e.*, cutting shoe). Analytical results indicate concentrations of radionuclides in all slag samples and seven soil samples (including the field duplicate) to be significantly higher than at background conditions.

On May 1, 2014, SAT personnel collected radon and thoron concentration measurements from locations on and in the vicinity of the Site. At the selected locations in background areas, above the source material, and off the source area, radon and thoron concentration measurements in pCi/L were collected with RAD7 radon detectors. The radon and thoron measurements were collected at heights of one meter above the ground surface. The measurements included uncertainty values, which were taken into account to calculate adjusted concentrations for evaluation of observed release in the air migration pathway. There were no radon or thoron concentrations that exceeded the site-specific background, nor were there any adjusted concentrations that equaled or exceeded a value two standard deviations above the mean site-specific background concentration for that radionuclide in that type of sample (*i.e.*, there is no evidence of an observed release to air from Site sources).

RST 3 Scope of Work:

Weston Solutions, Inc., Removal Support Team 3 (RST 3) has been tasked by EPA to provide support for radiation surveying and sampling to be conducted at the Site. Gamma radiation surveys will be conducted with the use of a Fluke 451P PIC, a Ludlum Model 2241, and a Reuter-Stokes RSS-131ER survey meter. Radon and thoron gas will be measured using a Durrige RAD7 radon detector. Specific isotopes will be identified using a Berkeley Nucleonics Corporation (BNC) SAM 940™ portable, radio-isotope identification system. In addition, RST 3 will conduct soil and radon sampling. RST 3 will provide a Geoprobe® subcontractor to be used for soil sample collection and a radiation specialist for radon canister sampling. The surveying and sampling locations will be determined on-site by the EPA On-Scene Coordinator (OSC).

Three (3) S.M.A.R.T. Health and Safety Goals for the Project (Simple, Measurable, Actionable, Reasonable, & Timely):

1. Safe operation of vehicles while traveling to and from the Site.
2. Adherence to the Weston Solutions, Inc., Radiation Safety Program during on-site activities, including the usage of time, distance, and shielding to limit radiation exposure.
3. Appropriate personal protective equipment (PPE) will be utilized throughout Site activities.

Incident Type:

- ☐ Emergency Response
- ☒ Removal Assessment: Beginning week of August 10, 2015
- ☐ Removal Action
- ☐ Residential Sampling/Investigation
- ☐ PRP Oversight
- ☐ Other

Location Class:

- ☐ Industrial
- ☐ Commercial
- ☒ Urban/Residential
- ☐ Rural

U.S. EPA OSC: Eric Daly Date of Initial Site Acti

vities: 8/10/2015

Original HASP: Yes

Site Health & Safety Coordinator: Joel Petty

Lead RST 3: Joel Petty Site Health & Safety Alter

nate: Robert Croskey

Response Activities/Dates of Response (fill in as applicable)

Emergency Response:

- ☐ Perimeter Recon
- ☐ Site Entry
- ☐ Visual Documentation
- ☐ Multi-Media Sampling
- ☐ Decontamination

Removal Assessment:

- ☒ Site Radiation Screening: Beginning week of August 10, 2015
- ☒ Site Entry: Beginning week of August 10, 2015
- ☒ Visual Documentation: Beginning week of August 10, 2015
- ☒ Multi-Media Sampling: Beginning week of August 10, 2015
- ☒ Decontamination: Beginning week of August 10, 2015

Removal Action:

- ☐ Perimeter Recon
- ☐ Site Entry
- ☐ Visual Documentation
- ☐ Multi-Media Sampling
- ☐ Decontamination

Physical Safety Hazards to Personnel:

- ☒ Inclement Weather – Attach FLD02
- ☒ Heat – Attach FLD05
- ☐ Cold – Attach FLD06
- ☐ Confined Space – Attach FLD08
- ☐ Industrial Trucks – Attach FLD09
- ☐ Manual Lifting – Attach FLD10

- | | | |
|---|---|---|
| <input checked="" type="checkbox"/> Terrain – Attach FLD11 | <input type="checkbox"/> Structural Integrity – Attach FLD13 | <input type="checkbox"/> Site Security |
| <input type="checkbox"/> Pressurized Containers, Systems – Attach FLD16 | <input type="checkbox"/> Use of Boats – Attach FLD18 | <input type="checkbox"/> Waterways – Attach FLD19 |
| <input type="checkbox"/> Explosives – Attach FLD21 | <input checked="" type="checkbox"/> Heavy Equipment – Attach FLD22 | <input type="checkbox"/> Aerial Lifts and Manlifts – Attach FLD24 |
| <input type="checkbox"/> Elevated Surfaces and Fall Protection – Attach FLD25 | <input type="checkbox"/> Ladders – Attach FLD26 | <input type="checkbox"/> Excavations/Trenching – Attach FLD28 |
| <input type="checkbox"/> Fire Prevention – Attach FLD31 | <input type="checkbox"/> Demolition – Attach FLD33 | <input checked="" type="checkbox"/> Underground/Overhead Utilities – Attach FLD34 |
| <input checked="" type="checkbox"/> Hand and Power Tools – Attach FLD38 | <input type="checkbox"/> Illumination – Attach FLD39 | <input type="checkbox"/> Storage Tanks – Attach FLD40 |
| <input type="checkbox"/> Lead Exposure – Attach FLD46 | <input checked="" type="checkbox"/> Sample Storage – Attach FLD49 | <input type="checkbox"/> Cadmium Exposure – Attach FLD50 |
| <input type="checkbox"/> Asbestos Exposure – Attach FLD52 | <input type="checkbox"/> Hexavalent Chromium Exposure – Attach FLD 53 | <input type="checkbox"/> Benzene Exposure – Attach FLD 54 |
| <input checked="" type="checkbox"/> Drilling Safety – Attach FLD56 | <input type="checkbox"/> Drum Handling – Attach FLD58 | <input type="checkbox"/> Gasoline Contaminant Exposure – Attach FLD61 |
| <input checked="" type="checkbox"/> Noise – Attach CECHSP, Section 7 | <input checked="" type="checkbox"/> Walking/Working Surfaces | <input type="checkbox"/> Oxygen Deficiency |
| <input type="checkbox"/> Unknowns in Tanks or Drums | <input type="checkbox"/> Nonionizing Radiation | <input checked="" type="checkbox"/> Ionizing Radiation Attach Radiation Safety Operating Practice |

Biological Hazards to Personnel:

- | | |
|---|--|
| <input type="checkbox"/> Infectious/Medical/Hospital Waste – Attach FLD 44 and 45 | <input checked="" type="checkbox"/> Non-domesticated Animals – Attach RST 3 FLD43A |
| <input checked="" type="checkbox"/> Insects – Attach RST 3 FLD 43B | <input checked="" type="checkbox"/> Poisonous Plants/Vegetation – Attach RST 3 FLD 43D |
| <input type="checkbox"/> Raw Sewage | <input type="checkbox"/> Bloodborne Pathogens – Attach FLD 44 and 45 |

Training Requirements:

- | | |
|---|--|
| <input checked="" type="checkbox"/> 40-Hour HAZWOPER Training with three days supervised experience | <input type="checkbox"/> 8-Hour Management or Supervisor Training in addition to basic training course |
| <input checked="" type="checkbox"/> 8-Hour Annual Refresher Health and Safety Training | <input checked="" type="checkbox"/> Site Specific Health and Safety Training |
| <input type="checkbox"/> DOT (CMV Training - ERV in Use) | <input type="checkbox"/> Bio-Medical Collection and Response |

Medical Surveillance Requirements:

- | | |
|---|---|
| <input checked="" type="checkbox"/> Baseline initial physical examination with physician certification | <input checked="" type="checkbox"/> Annual medical examination with physician certification |
| <input checked="" type="checkbox"/> Site-specific medical monitoring protocol (Radiation, Heavy Metals) | <input type="checkbox"/> Asbestos worker medical protocol |

Vehicle Use Assessment and Selection:

Driving is one of the most hazardous and frequent activities for Weston Employees. As such, Weston Employees are required to adhere to established safe operating practices in order to maintain their eligibility to drive Weston owned, leased, or rented vehicles. Every person riding in a Weston vehicle, including passengers must maintain a commitment for a safe journey. This means being attentive while in the vehicle and helping the driver to notice hazards ahead of and around the vehicle and ensure that their presence does not distract the driver from safely operating the vehicle.

A high percentage of vehicle accidents occur when operating in reverse. Anytime a vehicle is operated in reverse, e.g., backing out of a parking area, if there are passengers, at least one of them are to assist the driver by acting as a guide person during the reverse movement or during other vehicle operation where it would be prudent to have a guide person(s) participate in the vehicle movement. When practical, the preferred parking method would be to back into the parking area.

At a minimum, each Weston Driver must:

- Possess a current, valid drivers' license
- Current Commercial Motor Vehicle (CMV) card when operating the Emergency Response Vehicle
- Obey posted speed limits and traffic laws
- Wear seat belts at all times while the vehicle is in operation
- Conduct a 360 degree inspection around the vehicle before attempting to drive the vehicle
- Report accidents / incidents immediately and complete a Notice of Incident (NOI)
- Keep vehicles on approved roadways (4WD doesn't guarantee mobility on unapproved surfaces)
-

All Region II RST 3 personnel are experienced and qualified to drive RST 3 fleet vehicles (Tahoe, Suburban, Minivan/Cargo Van, and Emergency Response Vehicle). However, in the event that vehicle rental is required, each person must take the time to familiarize themselves with that particular vehicle. This familiarization includes adjustment of the dashboard knobs/controls, mirrors, steering wheel, seats, and a 360 degree external inspection of the vehicle.

1. The following vehicles are anticipated to be used on this project:

- | | |
|--|---|
| <input type="checkbox"/> Car | <input type="checkbox"/> Pickup Truck |
| <input checked="" type="checkbox"/> Intermediate/Standard SUV
(e.g. Chevy Trailblazer, Chevy Tahoe, Ford Explorer, Ford Escape) | <input checked="" type="checkbox"/> Full Size SUV (e.g. Chevy Suburban, Ford Expedition, GMC Yukon) |
| <input type="checkbox"/> Minivan/Cargo Van (e.g. Chevy Uplander, Chevy Express Van) | <input type="checkbox"/> Box Truck (Size: _____) |
| <input type="checkbox"/> Emergency Response Vehicle (ERV) | <input type="checkbox"/> Other _____ |

2. Are there any on-site considerations that should be noted:

- | | | | |
|--|--|--|---------------------------------------|
| <input checked="" type="checkbox"/> Working/Driving Surfaces | <input type="checkbox"/> Debris | <input type="checkbox"/> Overhead Clearance | <input type="checkbox"/> Obstructions |
| <input checked="" type="checkbox"/> Tire Puncture Hazards | <input checked="" type="checkbox"/> Vegetation | <input type="checkbox"/> Terrain | <input type="checkbox"/> Parking |
| <input type="checkbox"/> Congestion | <input type="checkbox"/> Site Entry/Exit Hazards | <input checked="" type="checkbox"/> Local Traffic Volume | <input type="checkbox"/> Security |
| <input type="checkbox"/> Heavy Equipment | <input type="checkbox"/> Time/Length of Work Day | <input type="checkbox"/> Other: | |

3. Do any of the considerations above require further explanation: No

4. Was the WESTON Environmental Risk Management Tool completed in EHS? Yes

Was an Environmental Compliance Plan required? No

5. Are there any seasonal considerations that should be noted (e.g., Anticipated Snowy Conditions): No _____

6. Is a Traffic Control Plan required? ☐ Yes ☒ No

Chemical Hazards to Personnel

Physical Parameters	<u>Radium</u> <u>(See Attachments)</u>	<u>Thorium</u> <u>(See Attachments)</u>	<u>Radon</u> <u>(See Attachments)</u>
Exposure Limits /	_____ ppm _____ mg/m ³ PEL	_____ ppm _____ mg/m ³ PEL	_____ ppm _____ mg/m ³ PEL
	_____ ppm _____ mg/m ³ REL	_____ ppm _____ mg/m ³ REL	_____ ppm _____ mg/m ³ REL
IDLH Level	_____ ppm _____ mg/m ³ IDLH	_____ ppm _____ mg/m ³ IDLH	_____ ppm _____ mg/m ³ IDLH
Physical Form (Solid/Liquid/Gas) Color	_____ Solid _____ Liquid _____ Gas Variable _Color	_____ Solid _____ Liquid _____ Gas Variable _Color	_____ Solid _____ Liquid _____ Gas Variable _Color
Odor			
Flash Point Flammable Limits	_____ Degrees F or C _____% UEL _____% LEL	_____ Degrees F or C _____% UEL _____% LEL	_____ Degrees F or C _____% UEL _____% LEL
Specific Gravity	_____ Water = 1	_____ Water = 1	_____ Water = 1
Solubility			
Incompatible Materials			
Routes of Exposure	_____ Inh _____ Abs _____ Con _____ Ing	_____ Inh _____ Abs _____ Con _____ Ing	_____ Inh _____ Abs _____ Con _____ Ing
Symptoms of Acute Exposure			
First Aid Treatment			
Ionization Potential	_____ eV	_____ eV	_____ eV
Instruments for Detection	_____ PID w/ _____ Probe _____ FID _____ CGI _____ RAD _____ Det Tube _____ Other _____ Lumex	_____ PID w/ _____ Probe _____ FID _____ CGI _____ RAD _____ Det Tube _____ Other _____ Lumex	_____ PID w/ _____ Probe _____ FID _____ CGI _____ RAD _____ Det Tube _____ Other _____ Lumex

Control Measures: Work zones will be established on-site during Site orientation.



*This map is subject to Google's Terms of Service, and Google is the owner of rights therein.
Portions of this image have been removed for clarity.*

Work Zone Definitions:

Each work/control zone can be described as follows:

Exclusion Zone - the area where contamination is either known or expected to occur and the greatest potential for exposure exists. The outer boundary of the Exclusion Zone, called the Hotline, separates the area of contamination from the rest of the Site.

Contamination Reduction Zone (CRZ) - the area in which decontamination procedures take place. The purpose of the CRZ is to reduce the possibility that the Support Zone will become contaminated or affected by the site hazards.

Support Zone - the uncontaminated area where workers are unlikely to be exposed to hazardous substances or dangerous conditions. The Support Zone is the appropriate location for the command post, medical station, equipment and supply center, field laboratory, and any other administrative or support functions that are necessary to keep site operations running efficiently.

Communications:

- | | |
|---|---|
| <input checked="" type="checkbox"/> Buddy System | <input type="checkbox"/> Radio |
| <input type="checkbox"/> Air Horn for Emergencies | <input checked="" type="checkbox"/> Hand Signals/Visual Contact |

Personnel Decontamination Procedures:

- ☐ Wet Decontamination (procedures as follows)
- ☒ Dry Decontamination (procedures as follows)

Radiation survey activities conducted as part of the Removal Assessment will be conducted in Level D PPE. All used PPE will be grossly decontaminated and disposed of in accordance with applicable federal, state, and local regulations.

Equipment Decontamination Procedures:

- ☐ None
- ☒ Wet Decontamination (procedures as follows)
- ☐ Dry Decontamination (procedures as follows)

All non-disposable stainless steel equipment (Geoprobe® drive shoes) involved in field sampling activities will be decontaminated in accordance to EPA Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2006 before, during, and after the sampling event. Following the dry removal of adhering soil to the greatest practical extent, decontamination will be conducted as: (1) – Alconox detergent and potable water scrub, (2) – Potable water rinse, distilled water rinse, (3) Hexane rinse followed by distilled water rinse and air dry.

All disposable sampling equipment (i.e., used acetate sleeves) will be cleaned of gross contamination, and disposed of in accordance with local, state, and federal regulations.

Adequacy of decontamination determined by: RST 3 Health and Safety Officer

Personal Protective Equipment

TASK TO BE PERFORMED	ANTICIPATED LEVEL OF PROTECTION	TYPE OF CHEMICAL PROTECTIVE COVERALL	INNER GLOVE / OUTER GLOVE / BOOT COVER	APR CARTRIDGE TYPE or SCBA
Soil and Radon Sampling	Level D	Proper work uniform, safety glasses	Nitrile/Nitrile/None	None
Gamma Radiation and Radon/Thoron Gas Surveying	Level D	Proper work uniform, safety glasses	Nitrile/Nitrile/None	None
Site Documentation Activities	Level D	Proper work uniform, safety glasses	Nitrile/Nitrile/None	None

Hazard Task Analysis

RISK LEVEL (High, Medium, Low)	HAZARD	RECOGNITION/ SYMPTOMS	MITIGATION	LEVEL OF PROTECTION
High	Exposure to low-level alpha and gamma radiation	Realtime radiation monitoring equipment and comparison to site specific action levels	PPE for contamination control and limit time in hot zone.	Level D
High	Working around heavy equipment	Activities conducted near heavy equipment have the potential for injury	Use of hard hats and steel toe boots, awareness of surroundings, and maintaining eye contact with equipment operator.	Level D
Medium	Slips, trips, and falls	Uneven surface, steep gullies, unstable sides of gullies	Stay away from uneven and unstable surfaces and side slopes	Level D

Frequency and Types of Air Monitoring:

☒ Continuous
 ☐ Routine - _____
 ☐ Periodic - _____

DIRECT READING INSTRUMENTS	Ludlum Model 2241 Survey Meter	Fluke 451P Ion Chamber Survey Meter	Reuter-Stokes RSS-131ER Survey Meter	DurrIDGE RAD7 Radon Detector	BNC Model 940 SAM Eagle+
EQUIPMENT ID NUMBER	TBD	TBD	TBD	TBD	TBD
CALIBRATION DATE	TBD	TBD	TBD	TBD	TBD
RST 3 /START III PERSONNEL	Joel Petty Robert Croskey	Joel Petty Robert Croskey	Joel Petty Robert Croskey	Joel Petty Robert Croskey	Joel Petty Robert Croskey
ACTION LEVEL	≥ 1000 uR/Hr– Exit Area, Establish Perimeter, Contact RST 3 HSO	≥ 1000 uR/Hr– Exit Area, Establish Perimeter, Contact RST 3 HSO	≥ 1000 uR/Hr– Exit Area, Establish Perimeter, Contact RST 3 HSO	NA	NA

Emergency Telephone Numbers

Emergency Contact	Location / Address	Telephone Number	Notified
Hospital	Mount St. Mary's Hospital and Health Center 5300 Military Road Lewiston, NY 14092	Call 911 or 716-297-4800	Yes
Ambulance	Twin City Ambulance 365 Fillmore Avenue Tonawanda, NY 14150	911	No
Police	Niagara Police Department 7105 Lockport Road Niagara Falls, NY 14305	Call 911 or 716-297-2150	No
Fire Department	Bergholz Fire Company 2470 Niagara Road Niagara Falls, NY 14304	Call 911 or 716-731-4848	No

Chemical Trauma Capability?

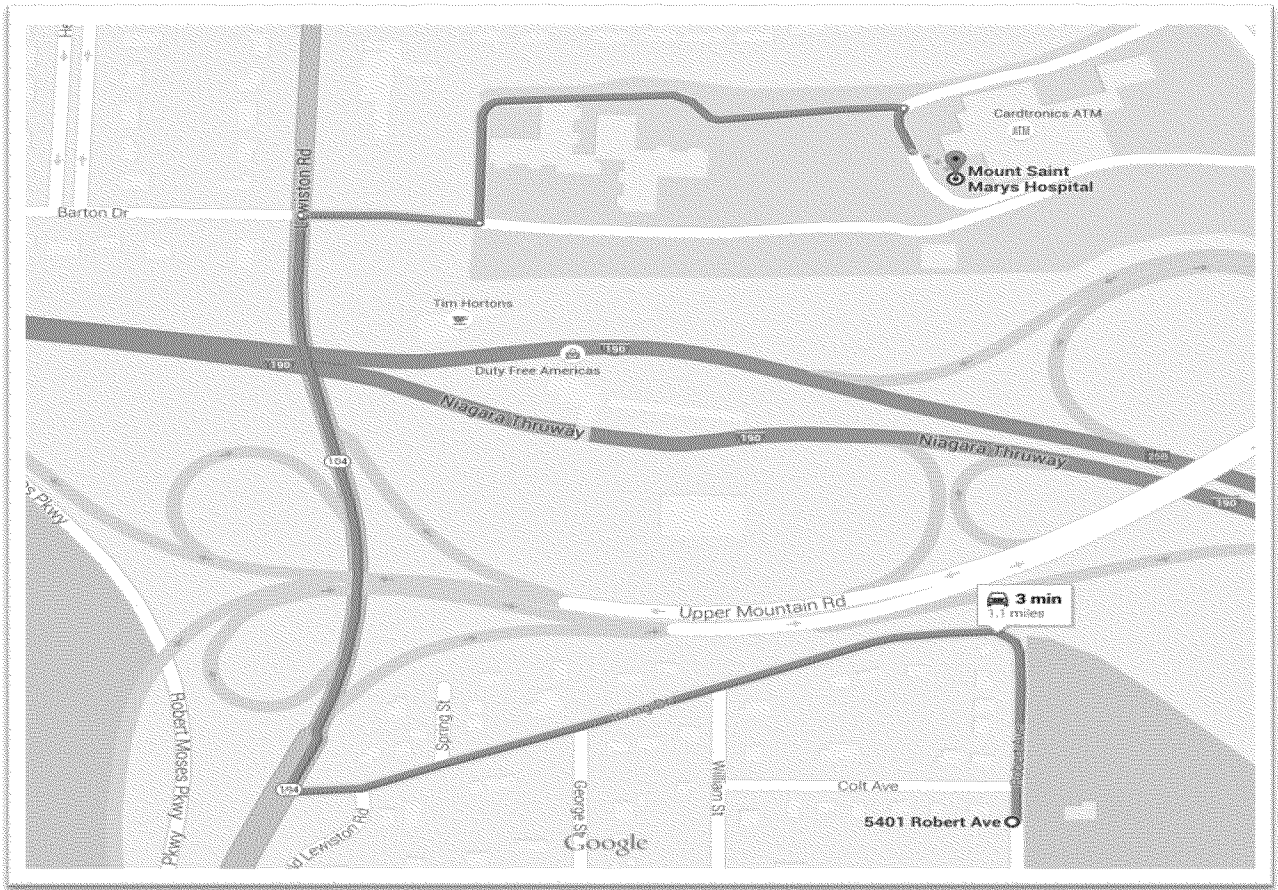
☒ Yes ☐ No

If no, closest backup: _____ Phone:

Directions to Hospital:

- | | |
|--|--------|
| 1. Head north on Robert Ave toward Colt Ave | 0.1 mi |
| 2. Robert Ave turns slightly left and becomes Irving Dr | 0.3 mi |
| 3. Turn right onto NY-104 E | 0.3 mi |
| 4. Turn right at Barton Dr | 387 ft |
| 5. Turn left | 0.2 mi |
| 6. Turn right ; DESTINATION WILL BE ON THE LEFT | 135 ft |

Total Distance: 1.1 mile: Total Time: 3 minutes. See map on following page.



*This map is subject to Google's Terms of Service, and Google is the owner of rights therein.
Portions of this image have been removed for clarity.*

Route verified by: _____ Date: __/__/__

Additional Emergency Telephone Contacts

WESTON Medical Emergency Service Dr. Peter Greaney, Medical Director WorkCare 300 South Harbor Blvd, Suite 600 Anaheim, California 92805	800-455-6155 Regular Business Hours (9AM to 7:30PM) Dial 0 or Ext. 175 for Michelle Bui to request the on-call clinician. 800-455-6155 After Hours (Weekdays 7:31PM to 8:59AM, Weekends, Holidays) Dial 3 to reach the after-hours answering service. Request that the service connect you with the on-call clinician or the on-call clinician will return your call within 30 minutes.
Chemtrec	800-424-9300
ATSDR	404-639-0615
ATF (explosives information)	800-424-9555
National Response Center	800-424-8802
National Poison Control Center	800-764-7661
Chemtel	800-255-3924
DOT	800-424-8802
CDC	800-232-0124

Pre-Response Approval

HASP prepared by: Michael Lang

Date: 8/4/2015

Pre-Response/Entry Approval by:  Date: 8/4/2015 _____

Tasks Conducted	Level of Protection/Specific PPE Used
Soil and Radon Sampling	Level D
Gamma Radiation and Radon/Thoron Gas Surveying	Level D
Site Documentation Activities	Level D

Hazardous Waste Site and Environmental Sampling Activities

Off Site: ☐ Yes ☒ No

On Site: ☒ Yes ☐ No

Describe types of samples and methods used to obtain samples:

RST 3 will conduct radiological surveys utilizing a Fluke 451 PIC, a Ludlum Model 2241, a Durridge RAD7, a Reuter Stokes 131 PIC, and a SAM 9 40. Refer to the Radiological Survey Work Plan for more details on all survey work.

RST 3 will conduct soil sampling in accordance with guidelines outlined in EPA ERT Soil Sampling SOP #2012. Soil samples will be obtained through the use of a Geoprobe[®]. Soil samples will be collected with a disposable scoop and homogenized in disposable pie pans and then placed into glass jars. Rocks and other debris will be removed from each sample to ensure sufficient sample volume prior to placing it into a jar.

RST 3 will conduct radon sampling using charcoal canisters. Testing will be determined using the American National Standards Institute (ANSI) *Protocol for Conducting Radon and Radon Decay Product Measurements In Multifamily Buildings*. Initial testing will comprise of short-term 72-hours tests using activated charcoal canisters.

The EPA recommends that testing should be conducted in “closed conditions” for up to 12 hours prior to sampling. Testing should be conducted in frequently occupied rooms, should be tested individually as radon concentrations can vary greatly from room to room in the same building. Restrooms, kitchens, utility closets, and hallways will not be tested because these may create a biased result. RST 3, with guidance from the EPA OSC and through the use of a certified radon subcontractor, will place the canisters at pre-determined locations for each property. Canisters will be raised above the ground approximately 20 inches, away from drafts or vents. The canisters will collect ambient air for approximately 72 hours at each location.

The EPA guidance document also determines the exposure limits for exposure to radon gas emissions. EPA recommends reducing the concentration of radon in air to be below 4 pCi/L or 0.02 Working Levels (WL). Sample results once received will be compared against these guidelines.

Was laboratory notified of potential hazard level of samples? ☒ Yes ☐ No

Note: The nature of the work assignment may require the use of the following procedures/programs which will be included as attachments to this Health and Safety Plan (HASP) as applicable: Emergency Response Plan, Confined Space entry Procedures, Spill Containment Program.

Disclaimer: This HASP was prepared for work to be conducted under the RST 3 Contract EP-S2-14-01. Use of this HASP by WESTON and its subcontractors is intended to fulfill the OSHA requirements found in 29 CFR 1910.120. Items not specifically covered in this HASP are included by reference to 29 CFR 1910 and 1926.

The signatures below indicate that the individuals have read and understood this Health and Safety Plan.

PRINTED NAME	SIGNATURE	AFFILIATION	DATE

Post-Response Approval

Final Submission of HASP by:		Date:
Post Response Approval by:		Date:
RST 3 HSO Review by:		Date:

Air Monitoring Summary Log

Date: __/__/__

Data Collected by: _____

Station/Location	CGI / O ₂ Meter / CL ₂ / H ₂ S	Radiation Meter	PID	FID / TVA-1000	Other (<u>PDR</u>)

ATTACHMENT A

RADIUM, RADON, AND THORIUM FACT SHEETS



<http://www.epa.gov/radiation/radionuclides/radium.html>
Last updated 3/6/2012

Radiation Protection

You are here: [EPA Home](#) [Radiation Protection](#) [References](#) [Reference Information](#)
[Radionuclides](#) Radium

[Students/Teachers](#) [Librarians](#) [Reporters](#) [General Public](#) [Technical Services](#)

[PROGRAMS](#) [TOPICS](#) [REFERENCES](#)

Radu

Radium (chemical symbol Ra) is a naturally-occurring radioactive metal. Its most common isotope is radium-226, and radium-228. Radium is a radionuclide formed by the decay of uranium and thorium in the environment. It occurs at low levels in virtually all rock, soil, water, plants, and animals.

On this page:

The Basics

- [When was radium discovered?](#)
- [Where does radium come from?](#)
- [What are the properties of radium?](#)
- [What is radium used for?](#)

Exposure to Radium

- [How does radium get into the environment?](#)
- [How does radium change in the environment?](#)
- [How does radium come in contact with radium?](#)
- [How does radium get into the body?](#)
- [What does radium do once it gets into the body?](#)

Health Effects of Radium

- [How can radium affect people's health?](#)
- [Is there a medical test to determine exposure to radium?](#)

Protecting People from Radium

- [How do I know if I'm near radium?](#)
- [What can I do to protect myself and my family from radium?](#)
- [What is EPA doing about radium?](#)

Reference Information

- [People and Discoveries](#)
- [Commonly Encountered Radionuclides](#)
 - [Americium-241](#)
 - [Cesium-137](#)
 - [Cobalt-60](#)
 - [Iodine-129 & 131](#)
 - [Plutonium](#)
 - [Radium](#)
 - [Radon](#)
 - [Strontium-90](#)
 - [Technetium-99](#)
 - [Tritium](#)
 - [Thorium](#)
 - [Uranium](#)
- [Glossary](#)
- [Acronyms](#)
- [A-Z Subject Index](#)
- [Site Map](#)

The Basics

Who discovered radium?

Radium was discovered in 1898 by French physicist pitchblende (uranium and radium-bearing mineral). In pitchblende. Elemental radium was isolated

and Nobel laureate Marie Curie. There is about 1 gram of radium in 7 tons of pitchblende. Marie Curie isolated it in 1911.

Where does radium come from?

Radium forms when isotopes of uranium and thorium (radium-226) originate from the decay of the parent

in the environment. Most radium is from uranium-238.

In the natural environment, radium occurs at very low levels in plants and animals. When uranium (thorium) occurs in high levels.

levels in virtually all rock, soil, water, and in high levels in rock, radium is often

What are the properties of radium?

Radium is a naturally radioactive, silvery-white metal that tarnishes in air.

It blackens when freshly cut. It blackens

Purified radium and some radium compounds will emit light by radium can cause certain materials, radium salts and appropriate phosphors were used in the risks of radium exposure were understood.

in the dark (luminescence). The radiation called "phosphors" emit light. Mixtures of radium salts and phosphors were used in clock dials and gauges before

Metallic radium is highly chemically reactive. It forms compounds, making separation from the elements

compounds that are very similar to each other.

The various isotopes of radium originate from the decay of uranium-238 and thorium-232 decay series.

radioactive decay of uranium and thorium. Radium-226 and -228 are found in

Radium-226, the most common isotope, is an alpha emitter and has a half-life of about 1600 years. Radium-224, an alpha emitter, has a half-life of 3.66 days. Radium decays to form isotopes of the radioactive element lead. Stable lead is the final product of this

process, with accompanying gamma radiation. Radium-228, is principally a beta emitter and has a half-life of 14.1 days. It decays to form isotopes of the radioactive element lead. Stable lead is the final product of this

What is radium used for?

In the early 1900's, when it was newly discovered, people were fascinated with its mysterious properties when it is mixed with phosphorus. Industries sprang up to produce products containing radium. Advertisements for unique effects in such products such as hair tonic, the dark watch and clock faces were immensely popular.

None understood the dangers of radium. It was used, especially in the luminescence produced by radium in the manufacture of hundreds of products. It was claimed that it had special powers and was used in toothpaste, ointments, and elixirs. Glow in the dark

Most of its original uses have been halted after the war. Luminescent paints continued through World War II, luminescence made aircraft dials, gauges and other instruments visible at night. Radium was also used in the treatment of cancer.

It was used in the treatment of cancer, but its use was stopped because of the danger of radium's radiation. Instruments visible at night and cancer treatment. Small seeds were

implanted into tumors to kill cancer cells. Safer, cobalt-60 have mostly replaced it.

more effective radiation sources, such as

Radium is a radiation source in some industrial radiography devices, a technology similar to x-ray imaging used in industry to inspect for flaws in metal parts. When radium is mixed with beryllium, it becomes a source of neutrons, used in well logging devices and research. Radium has also been added to the tips of flight instruments, improving their effectiveness by ionizing the air around it.

graph devices, a technology similar to x-ray imaging used in industry to inspect for flaws in metal parts. When radium is mixed with beryllium, it becomes a source of neutrons, used in well logging devices and research. Radium has also been added to the tips of flight instruments, improving their effectiveness by ionizing the air around it.

Exposure to Radium

How does radium get into the environment?

Radium occurs naturally in the environment. As a common mineral in rocks, soil, and water. Usual geological processes can form concentrated sources of uranium and radium. Radium and its salts are found in areas where concentrations of radium are high in soil and water.

Radon products, uranium and thorium, it is usually concentrated in very low levels. However, radium is a radioactive element, especially in water. As a result, groundwater in some areas typically has relatively high concentrations of radium.

How does radium change in the environment?

All isotopes of radium are radioactive. As they decay, they become stable lead. The most common isotope, radium-226, decays through several steps to become radium-224 before forming

radon, they emit radiation and form new isotopes of radium decay from different radon-222, and radium-228 gives radon-220.

How do people come in contact with radium?

Since radium is present at low levels in the natural environment, everyone has some in their body. However, individuals may be exposed to higher levels of radium if they live in an area where there is an elevated level of radium in the surrounding rock and soil. Private wells in such areas can also be added to the source.

environment, everyone has some in their body. However, individuals may be exposed to higher levels of radium if they live in an area where there is an elevated level of radium in the surrounding rock and soil. Private wells in such areas can also be added to the source.

The concentration of radium in drinking water is generally low, but there are specific areas in the United States where high levels of radium are found in the water. Limited information is available about the amount of radium that is typically present in food and air, but they are

generally low, but there are specific areas in the United States where high levels of radium are found in the water. Limited information is available about the amount of radium that is typically present in food and air, but they are

People can also be exposed to radium if it is released from the fuels. Certain occupations can lead to high exposure to radium, such as working in uranium mining or in a plant that processes relatively high levels of both uranium and radium in areas where phosphate is mined.

sediment in the air from the burning of coal or high exposure to radium, such as working in a phosphate plant. Phosphate rock typically contains radium and can be a potential source of exposure.

In some parts of the country, from radium processing contaminated with radium. However, most of these have serious health threats to anyone.

ing plants exist that were highly contaminated with radium. However, most of these have been cleaned up and do not pose a

Radium emits several different kinds of radiation, Alpha radiation is only a concern if radium is taken into the body. Gamma radiation, rays, can expose individuals in the ground, for example, can expose individuals inhaled or ingested with contaminated drinking water in the environment, however, it actually decays rapidly.

in particular, alpha and gamma radiation. In the body through inhalation or ingestion, even at a distance. As a result, individuals externally get gamma rays. The greatest health risk from radium is from radon, which can collect in buildings.

How does radon get into the body?

People may swallow radium with food and water, or radium can be produced in the body from "parent" radionuclides that have been inhaled or swallowed, but this is a small amount.

They inhale it as part of dust in the air. "Radon" radionuclides (uranium and thorium) are a significant source.

What does radon do once it gets into the body?

Most radium that is swallowed (about 80%) promptly leaves the body through the feces. The 20% that enters the bloodstream and accumulates, radium is excreted through the feces and urine, but a small amount remains in the body throughout the person's lifetime.

leaves the body through the feces. The 20% that enters the bloodstream and accumulates, radium is excreted through the feces and urine, but a small amount remains in the body throughout the person's lifetime.

Health Effects of Radon

How can radon affect people's health?

Radium emits several different kinds of radiation, alpha particles and gamma rays. Alpha particles are generally only harmful if inhaled or ingested, but gamma rays can penetrate the body, so gamma emitters like radium can result in exposure even when the source is a distance away.

in particular, alpha particles and gamma rays are emitted inside the body. However, both are harmful. Gamma rays can penetrate the body, so exposure can occur even when the source is a distance away.

Long-term exposure to radium increases the risk of developing leukemia and diseases that affect the bone marrow, such as anemia. External exposure increases the risk of cancer, but the risk is much lower than for internal exposure.

developing several diseases. Inhaled radon can cause diseases such as lymphoma, bone cancer, and leukemia and aplastic anemia. These diseases are caused by radium's gamma radiation in all tissues and organs.

However, the greatest health risk from radium is from radon. It is common in many soils and can collect in homes and other buildings.

long-term exposure to radionuclides from radon decay products in homes and other buildings.

- [Radon](#)
This factsheet describes the basic properties and health effects of radon. It also discusses radon testing and mitigation.
- [Radon Home Page](#)
This site provides information about the hazards and health effects of radon, and the hazards associated with radon.

uses, and the hazards associated with radon. This site provides information about the hazards and health effects of radon, and the hazards associated with radon.

Is there a medical test to determine exposure to radium?

There are tests that can determine exposure to radium. For example, a whole body count can measure the total amount of radium in the body, and urine and feces can be tested for the presence of radium.

For most radioactive substances, the amount of radiation in the body, and the amount of radiation in the body, and the amount of radiation in the body.

These tests are routinely performed in a doctor's office because they require special laboratory equipment. There is no test that can detect radium, unless the dose was very high, and cell damage is detectable.

's office because it requires special external exposure to radium's gamma radiation damage is detectable.

Protecting People from Radium

How do I know if I'm near radium?

You need special equipment to detect the presence of radium. However, you can buy radon detection kits at most hardware stores.

radium. However, you can buy radon detection kits at most hardware stores.

What can I do to protect myself and my family from radium?

The most effective way to protect yourself and your family is to test your home for radon. Radon is a radioactive gas that can be found in the soil and in some building materials.

family is to test your home for radon. Radon is a radioactive gas that can be found in the soil and in some building materials.

- [Radon Home Page](#)
This site provides information about the hazards of radon and how to manage radon.

What does EPA do about radium?

The U.S. Congress passes laws that authorize EPA and other federal agencies to protect public health and the environment from radium and other radioactive materials. EPA has issued a variety of regulations that limit the release of radium and other radioactive materials into the environment. For example, Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA). EPA has established standards for cleaning up inactive reprocessing plants under the authority of UMTRCA. The U.S. Department of Energy is responsible for conducting the cleanups, and the U.S. Nuclear Regulatory Commission oversees and manages them.

other federal agencies, to protect the radioactive materials. EPA has issued a variety of regulations that limit the release of radium and other radioactive materials into the environment. For example, Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA). The U.S. Department of Energy is responsible for conducting the cleanups, and the U.S. Nuclear Regulatory Commission oversees and manages them.

- [UMTRCA](#)
This page provides a summary and links to the full text of the UMTRCA statute.

Complementing these efforts, EPA's Superfund program identifies abandoned industrial sites contaminated with radium and other radionuclides and environmental risks at these sites, and assigns the risks. Superfund regulations require sites to be cleaned up to the point that people living at the sites after cleanup would have no increased risk of developing cancer from exposure to radium and other radionuclides.

mid identifies abandoned industrial sites contaminated with radium and other radionuclides and environmental risks at these sites, and assigns the risks. Superfund regulations require sites to be cleaned up to the point that people living at the sites after cleanup would have no increased risk of developing cancer from exposure to radium and other radionuclides.

- CERCLA

This page provides summary and link to the complete statute.

- Superfund

This site contains information about individual Superfund sites.

Other laws passed by Congress address specific environmental media. The Clean Air Act authorizes EPA to establish annual limit, known as the National Ambient Air Quality Standard (NAAQS), for the maximum amount of radium and other radionuclides that may be released to the air. For radium the "NESHAP" (National Emission Standards for Hazardous Air Pollutants) Act authorizes EPA to limit the Maximum Contaminant Level (MCL) of radium and other radionuclides in publicly supplied drinking water. For 226 and 228 radium, the MCL is 5 picocurie per liter and for 224 radium it is 15 pCi/l. Both the air and water standards limit the increased lifetime cancer risk to about 2 in 10,000.

- Clean Air Act

This page provides summary and link to the complete statute.

- Safe Drinking Water Act

This page provides summary and link to the complete statute.

Understanding Radiation in Your Life, Your World

Program · Topic · Reference



<http://www.epa.gov/radon/radonulides/thorium.html>
Last updated 2/28/2014

Radon Protection

You are here: [EPA Home](#) [Radon Protection](#) [References](#) [Reference Information](#)
[Radionuclides](#) [Thorium](#)

[Students/Teachers](#) [Librarians](#) [Reporters](#) [General Public](#) [Technical Services](#)

[PROGRAMS](#) [TOPICS](#) [REFERENCES](#)

Thorium

Thorium (chemical symbol Th) is a naturally-occurring radioactive metal found at very low levels in soil, water. It has several different isotopes, both naturally made, all of which are radioactive. The most common thorium is thorium-232, found naturally.

Thorium is found in rocks, and is a man-made form.

Reference Information

- People and Discoveries
- Commonly Encountered Radionuclides
 - Americium-241
 - Cesium-137
 - Cobalt-60
 - Iodine-129 & 131
 - Plutonium
 - Radium
 - Radon
 - Strontium-90
 - Technetium-99
 - Tritium
 - Thorium
 - Uranium
- Glossary
- Acronyms
- A-Z Subject Index
- Site Map

On this page:

The Basics

- [When was thorium discovered?](#)
- [Where does thorium come from?](#)
- [What are the properties of thorium?](#)
- [What is thorium used for?](#)

Exposure to Thorium

- [How does thorium get into the environment?](#)
- [How does thorium change in the environment?](#)
- [How are people exposed to thorium?](#)
- [How does thorium get into the body?](#)
- [What does thorium do once it gets into the body?](#)

Health Effects of Thorium

- [How can thorium affect people's health?](#)
- [Is there a medical test to determine exposure to thorium?](#)

Protecting People from Thorium

- [How do I know if I'm near thorium?](#)
- [What can I do to protect myself and my family from thorium?](#)
- [What is EPA doing about thorium?](#)

The Basics

Who discovered thorium?

Thorium was discovered in 1828 by the Swedish chemist Jöns Jakob Berzelius. After determining that it was a new element, Berzelius named it after the Norse god Thor.

After his discovery of thorium, Berzelius also discovered cerium, selenium, and tellurium.

thunder and weather. Thorium was discovered by Gerhard Carl Schmidt and by Marie Curie.

beractive independently in 1898

Where does thorium come from?

Almost all thorium is natural, but, thorium is present at very low levels in virtually all rocks, and animals as well. Minerals such as monazite, may be mined for the metal. Generally, artificial made radionuclides, absorb in nuclear reactions.

can be artificially produced. Thorium, and water, and therefore is found in plants, and the thorium is enriched in thorium and some from decay of the man-made.

What are the properties of thorium?

Thorium is a soft, silvery white metal. Pure thorium contains impurities that tarnish to black when exposed to air. Thorium-232 has a half-life of 14 billion years, and emits alpha particles, with accompanying gamma radiation. Thorium-232 is the parent of a decay series that includes radon-222, which can be a health hazard, and thorium-232. Both belong to the decay series, accompanying gamma radiation, and have half-lives respectively.

will remain shiny for months in air, but if exposed to air. When heated, thorium oxide is used in incandescent light bulbs. It dissolves slowly in water. Thorium-232 is the parent of a decay series that includes radon-222, which can be a health hazard, and thorium-232. Both belong to the decay series, accompanying gamma radiation, and have half-lives respectively.

What is thorium used for?

Thorium has several properties that have made it useful in many applications. It is used in incandescent light bulbs, and in welding rods, which burn better than tungsten. Thorium is also used in the aerospace industry. More than 30 hospitals make certain kinds of diagnostic X-ray equipment.

ful in ceramic glazes. But, it has been used in many other applications. It is used in incandescent light bulbs, and in welding rods, which burn better than tungsten. Thorium is also used in the aerospace industry. More than 30 hospitals make certain kinds of diagnostic X-ray equipment.

Exposure to Thorium

How does thorium get into the environment?

Natural thorium is present in very small quantities in rocks, and animals. Where high concentrations occur in rocks, producing waste products such as mill tailings. If introduced to the environment, processed thorium may have released thorium, which is a health hazard, and almost never enters the environment.

in virtually all rocks, soil, water, plants, and animals. Thorium may be mined and refined, and then used in many applications. It is used in incandescent light bulbs, and in welding rods, which burn better than tungsten. Thorium is also used in the aerospace industry. More than 30 hospitals make certain kinds of diagnostic X-ray equipment.

How does thorium change in the environment?

Asthorium-232undergoesradioactivedecay,itemit gamma radiation,andformsradium-228.Thisprocess newradionuclidecontinuesuntilstablelead-208is about14billionyears.Twootherisotopesofthorium,arethorium-230andthorium-228.Both accompanying gamma radiation,in75,400yearsand1

sanalphaparticle,withaccompanying freleasingradiationandforminga formed.Thehalf-lifeofthorium-232is um,whichcanbesignificantinthe decaybyalphaemission,with .9years,respectively.

How are people exposed to thorium?

Since thorium is naturally present in the environment, in air, food and water. The amounts are usually very small. Thorium is also present in many consumer products and welding rods.

nt, people are exposed to tiny amounts in malleable and some health hazard. uch as ceramic glazes, lantern mantles,

People who live near a facility that mines or mills thorium, may receive higher exposures. Also, people in industries may receive higher exposures.

thorium, manufactures products with wherewith thorium in various

How does thorium get into the body?

People may inhale contaminated dust, or swallow with thorium contaminated site, or working in an industrial chance of exposure to thorium.

rium with food or water. Living near a y where thorium is used, increases your

What does thorium do once it gets into the body?

If inhaled as dust, some thorium may remain in the chemical form. If ingested, thorium typically within several days. The small amount of thorium and be deposited in the bones where it may remain for that the body may absorb thorium through the skin, means of entry.

lungs for long periods of time, depending y leaves the body through feces and urine f in the body will enter the bloodstream r many years. There is some evidence but that would not likely be the primary

Health Effects of Thorium

How can thorium affect people's health?

The principal concern from low to moderate levels of exposure is risk of cancer. Studies have shown that inhaling thorium developing lung cancer, and cancer of the pancreas. because thorium may be stored in bone.

posure to ionizing radiation is increased rium dust causes an increased risk of Bnecancer risk is also increased

Is there a medical test to determine exposure to thorium?

hrium in the urine, feces, and saliva
 exposed to thrium. These tests are
 Yuneeds special equipment to detect
 spitals. Some federal facilities and

pecialtraining.Healthphysicistsand
rium.

thorium. However, people who live near industrial facilities may have increased exposure to radon. Analytical laboratories use radon in their work. Radon is used in the glass, gas, and health industries, but may nevertheless be a radiation concern. It is required to confirm

by establishing standards for the
the amount of the (and the
specific sources of funding in public

ated sites generally fall under the
and Liability Act, commonly called
tar are relevant and applicable, such as
in with the environmental laws. When
t protective enough, EPA sets site-specific
cancer due to exposure to site-related
00 and in 1,000,000.

iumandthriummilltailingsitesunder
federalregulatinsarefundin40CFR192,
UraniumandThriumMillTailings").
fClrad,Utah,AriznaandNew

- EPA's Superfund Hotline: 1-800-424-9346 or 1-800-535-0202
- Clean Air Act
EPA uses this authority to set limits on the emissions of specific pollutants. Hazardous air pollutants include those that are known or suspected to cause serious health problems. While air emissions are limited as a group, not all hazardous air pollutants are regulated.
 - RadNESHAPS
This site provides information on EPA's National Emission Standards for Hazardous Air Pollutants: Radionuclides.
- Radionuclides in Drinking Water
This site provides information about radionuclides in drinking water and guidance to help states and water systems comply with the Safe Drinking Water Act authority to establish maximum contaminant levels (MCLs) for radionuclides. The MCL for alpha emitters is 15 picocuries per liter of water.

Understanding Radiation in Your Life, Your World

Programs Topics References



<http://www.epa.gov/radiation/radionuclides/radn.htm> ml
Last updated 2/13/2013

RadiatinPrtectin

Yuarehere: EPAHme RadiatinPrtectin References ReferenceInf rmatin
Radinuclides Radn

Students/Teachers Librarians Reporters General Public Technical Services

PRORAMS TOPICS REFERENCES

Radon

Radon (chemical symbol Rn) is a naturally occurring radioactive gas found in soils, rocks, and water throughout the U.S. It has numerous different isotopes, but radon-222 are the most common. Radon causes lung cancer, a threat to health because it tends to collect in some of the most vulnerable areas of the body. As a result, the largest source of exposure to radon is from the air we breathe.

ughutthe
220, and
and is
mes,
radnis
ngradiatin.

Reference Inforaton

- PepleandDiscveries
- CmmnlyEncuntered Radinuclides
 - Americium-241
 - Cesium-137
 - Cbalt-60
 - Idine-129&-131
 - Plutnium
 - Radium
 - Radn
 - Strntium-90
 - Technetium-99
 - Tritium
 - Thrrium
 - Uranium
- Glsary
- Acrnymss
- A-ZSubjectIndex
- SiteMap

On this page:

TheBasics

- Whdiscoveredradn?
- Wheredesradncmefrm?
- Whatarethepropertiesfradn?
- Desradnhaveanypracticaluses?

ExpsuretRadn

- Hwdesradngetinttheenvirnment?
- Hwdesradnchangeintheenvirnment?
- Hwarepepleexpseadradn?
- Hwdesradngetintthebdy?
- Whatdesradndnceitgetsinthebdy?

HealthEffectsfRadn

- How can radon affect people's health?
- Is there a medical test to determine exposure to radon?

Protecting People From Radon

- HwdIknwifthereisradninmyhme?
- WhatcanIdtprtectmyselfandmyfamilyfrm_____radn?
- Whatrecmmendatins hasthefederalgvernmentma_____detprtecthumanhealth
frmradn?
- WhatisEPAdingabutradn?

The Bascs

Who Discovered Radon

The German chemist Friedrich E. Dorn discovered radon emanation. However, as a cancerist, radon-220, with the British scientist, R. B. Owens, and the New Zealand medical community nationwide became aware of the problem in 1984. That year a nuclear plant worker in Pennsylvania was killed while exiting his place of work through the radon gas. The radon was determined to be a radon decay product of radium.

Radon-222 in 1900, and called it radium as it was actually observed first, in 1899, by the British scientist, Ernest Rutherford. The possible extent of radon problem in the United States was discovered by his discovery of radioactivity in his work with radon detectors. The source of the radon gas is the natural decay of uranium.

Where does radon come from?

Radon-222 is the decay product of radium-226. Radon is part of the long decay chain of uranium-238. Since the earth's crust, radium-226 and radon-222 are present

in radon-222 and its parent, radium-226, are found in the earth's crust, radium-226 and radon-222 are found in the earth's crust, radium-226 and radon-222 are found in the earth's crust.

More Info

- Decay Chains-Uranium Decay
This link provides an illustration of the uranium-238 decay chain, showing how radon-222 is produced from the decay of uranium-238.
- Uranium
This factsheet describes the basic properties and uses of uranium. It also discusses radon and its health effects.

decay through a series of steps

uses, and the hazards associated with radon exposure.

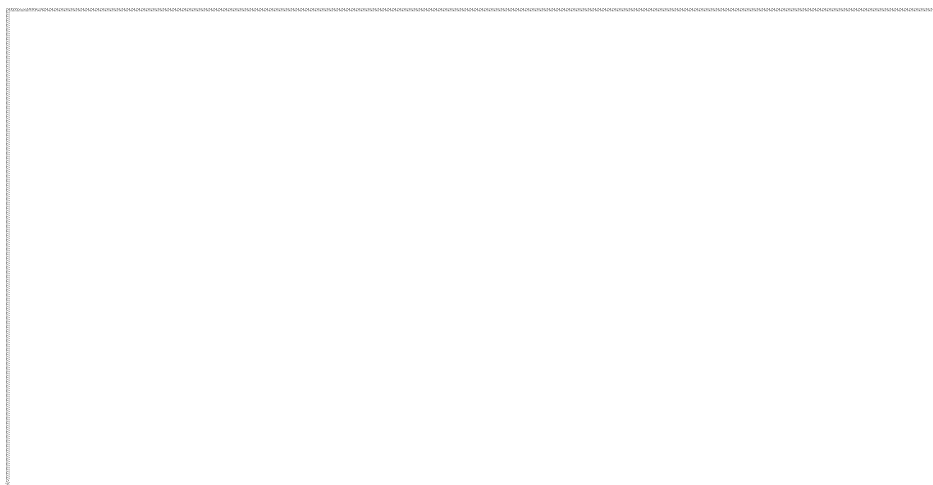
What are the properties of radon?

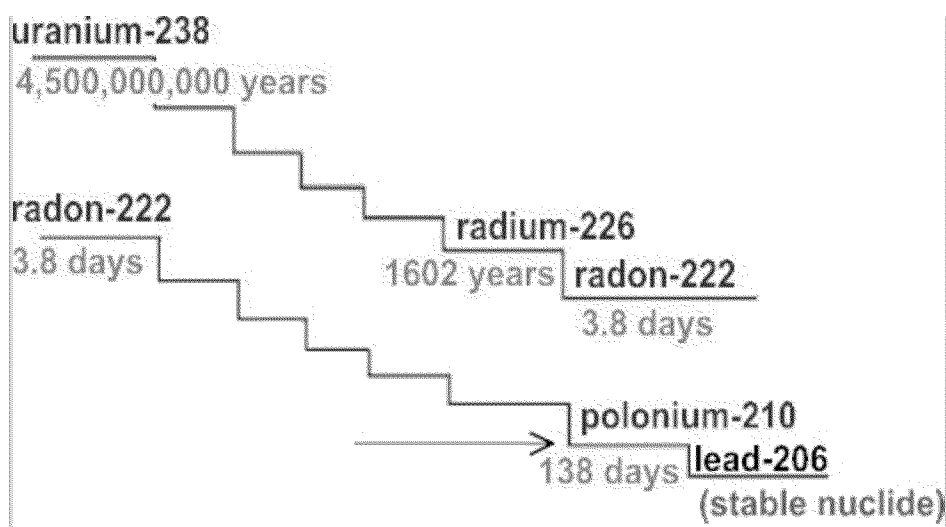
Radon is a gas, which means it is basically invisible. Radon is a heavy gas and tends to collect in low-lying areas. It has no color, odor, or taste. Radon-222 has a half-life of 3.8 days, and emits an alpha particle. Radon-220, is the decay product of thorium-232, and has a half-life of 54.5 seconds and emits an alpha particle.

inert (does not combine with other elements). Radon is found in the earth's crust, radium-226 and radon-222 are found in the earth's crust, radium-226 and radon-222 are found in the earth's crust.

The illustration below provides an overview of the radon decay chain and is produced by the EPA.

uranium-238 decay chain. Radon is part of the decay chain of uranium-238.





More Info

- [RadiativeDecay](#)
Thispageexplainsradiativedecaychains.

Does radon have any practical uses?

Radon has little practical use. Some medical treatment uses glass tubes, called seeds, that are specially manufactured to contain the exact amount of radioactivity needed for the application. Radon is used in Central Europe to treat a number of conditions.

Some have employed radon in small sealed containers to contain the exact amount of radioactivity. These are used extensively in Russia and

Exposure to Radon

How does radon get into the environment?

Radon-222 is the radioactive decay product of radium-226, which is found in rocks and soil. Radon enters buildings through cracks and spaces between particles in the soil. Radon concentrations in radon are typically low, about 0.1 pCi/l. Radon can seep into buildings through cracks and spaces in the foundation, if the sources are large enough.

The average indoor radon concentration is about 1.3 pCi/l. Indoor radon levels can be found in the range of 1 to 20 pCi/l. The concentration of radon in the air depends on many factors, including the design of the house, the type of radon source, and the weather. Radon's decay products are all metallic solids, and these can cling to dust and dirt, which makes them available for inhalation in the lungs.

Radon easily dissolves in water in areas where the concentration is high. Groundwater may contain high concentrations of radon, especially in areas with granite, which typically have increased uranium and

radon-226, which is found in rocks and soil, and it creeps into the air. Although it is only 4 picuries per liter (pCi/l) in the air, it can build up to much higher concentrations in enclosed spaces.

Radon-222 is found in the air. It is not uncommon, though, to find radon levels as high as 5-50 pCi/l, and they have been found in some areas. The concentration of radon in the air depends on many factors, including the design of the house, the type of radon source, and the weather. When radon decays in the air, the decay products are available for inhalation in the lungs.

Radon has a high radium content in some areas. For example, radon typically has increased uranium and

radium, and therefore radon. While radon easily dissolves in water when exposed to the atmosphere, especially in rivers and lakes, but could still be high in such as Hot Springs, Arkansas, contain radon, and were once considered healthful.

When radon is dissolved in water, it easily escapes if it is stirred or agitated. In rivers and lakes, but could still be high in such as Hot Springs, Arkansas, contain radon, and were once considered healthful.

More Info

- [Radon in Water](#)
This site provides information in Public Health Standards for Radon in Drinking Water
- [Radon Home Page](#)
This site provides information about the hazards and management of radon.
- [EPA Map of Radon Zones](#)
The purpose of this map is to assist National, State, and local organizations to target building codes.

Radon in Drinking Water

Management of Radon

and local organizations target building codes.

How does radon change in the environment?

Because radon is a chemically inert (unreactive) gas and arrives at the surface. The half-life of radon-222 is 3.8 days. As it undergoes radioactive decay, radon-222 releases an alpha particle and changes into polonium-218, a short-lived radioactive isotope. After several more *transformations* (loss of particles or electromagnetic radiation from the nucleus), the series ends at lead-206, which is stable.

Radon can move easily through cracks and holes in soil, and it can move easily through cracks and holes in buildings. As it undergoes radioactive decay, radon-222 releases an alpha particle and changes into polonium-218, a short-lived radioactive isotope. After several more *transformations* (loss of particles or electromagnetic radiation from the nucleus), the series ends at lead-206, which is stable.

Radon dissolves in water, and easily leaves water, especially if the water is agitated. Consequently, radon levels are very low in rivers and lakes, but water drawn from underground can have a level that decays in water, leaving only stable decay products.

Radon is exposed to the atmosphere, and radon levels are very low in rivers and lakes, but water drawn from underground can have a level that decays in water, leaving only stable decay products.

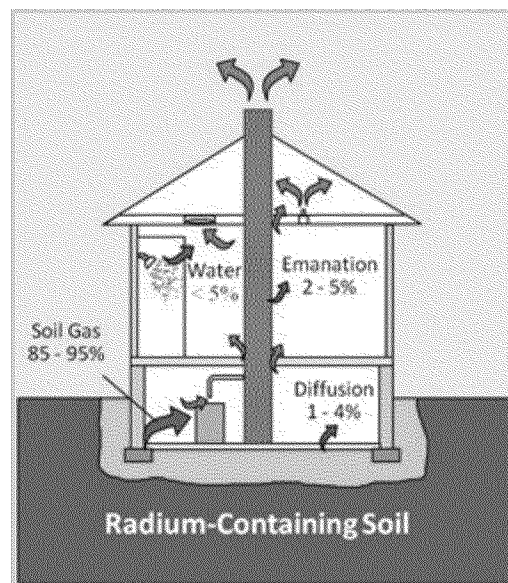
How are people exposed to radon?

Most of the public's exposure to natural radiation comes from radon, which can be found in homes, schools, and office buildings. The illustration at right shows the sources of radon that can accumulate in buildings.

Most radon in homes comes from radon in the soil that seeps in through cracks in the foundation or slab. The amount of radon in the soil varies widely and depends on the chemical makeup of the soil. There can be a large difference in radon concentrations in the soil from house to house. The only way to know is to test.

Radon is also found in the water in homes, in particular, homes that have their own well rather than municipal water. When the water is agitated, as when showering or washing dishes, radon escapes into the air. However, radon from water in the home

right



n

s

generally contributes only a small

proportion (less than 5%) of the total radon in indoor systems should be treated with water, which helps to release the radon before the water reaches your home. But, people in areas with high radon in the soil may be exposed to

radon in drinking water. Municipal water systems should test for radon, and levels are very low by law. If you have private wells, particularly in areas with higher levels of radon in the water, you should consider treating the water.

EPA estimates that the national average indoor radon level is about 1.3 pCi/l. EPA recommends taking action if the radon level is 4 pCi/l or higher. In some areas, radon levels as high as 20 pCi/l have been measured. If you are concerned about radon in your home, you can have it tested.

Radon in drinking water can contribute to the total radon exposure. EPA estimates that radon in drinking water contributes about 0.1 to 1 pCi/l to the total radon exposure. If you have a private well, you should consider testing for radon in the water. If the level is 4 pCi/l or higher, you should consider treating the water.

More Info

- [Radon in Water](#)
This site provides information on Public Health Standards for Radon in Drinking Water.
- [Radon Home Page](#)
This site provides information about the hazards and management of radon.

How does radon get into the body?

People may ingest trace amounts of radon with food and water. However, inhalation is the primary route of exposure. Radon and its decay products can be inhaled from the air. When inhaled, some of these decay products can stick to the lining of the lungs. Some of these particles can be inhaled and enter the lungs when breathed in. Some of these particles can be inhaled and enter the lungs when breathed in. Some of these particles can be inhaled and enter the lungs when breathed in.

Radon and its decay products can be inhaled from the air. When inhaled, some of these decay products can stick to the lining of the lungs. Some of these particles can be inhaled and enter the lungs when breathed in. Some of these particles can be inhaled and enter the lungs when breathed in. Some of these particles can be inhaled and enter the lungs when breathed in.

What does radon do once it gets into the body?

Most of the radon gas that you inhale is exhaled and does not stay in the body. Some of the radon gas that you inhale is exhaled and does not stay in the body. Some of the radon gas that you inhale is exhaled and does not stay in the body. Some of the radon gas that you inhale is exhaled and does not stay in the body.

However, some radon's decay products can stay in the lungs. These decay products can be inhaled and enter the lungs when breathed in. Some of these particles can be inhaled and enter the lungs when breathed in. Some of these particles can be inhaled and enter the lungs when breathed in.

Most of the radon that is in drinking water is excreted in the urine. Some of the radon that is in drinking water is excreted in the urine. Some of the radon that is in drinking water is excreted in the urine. Some of the radon that is in drinking water is excreted in the urine.

There is a small risk from radon in drinking water. This risk is small because the radon in drinking water is excreted in the urine. Some of the radon that is in drinking water is excreted in the urine. Some of the radon that is in drinking water is excreted in the urine. Some of the radon that is in drinking water is excreted in the urine.

Health Effects of radon

How can radon affect people's health?

Almost all risk from radon comes from breathing air. The health risk of ingesting (swallowing) radon, not the risk of inhaling radon and its decay products.

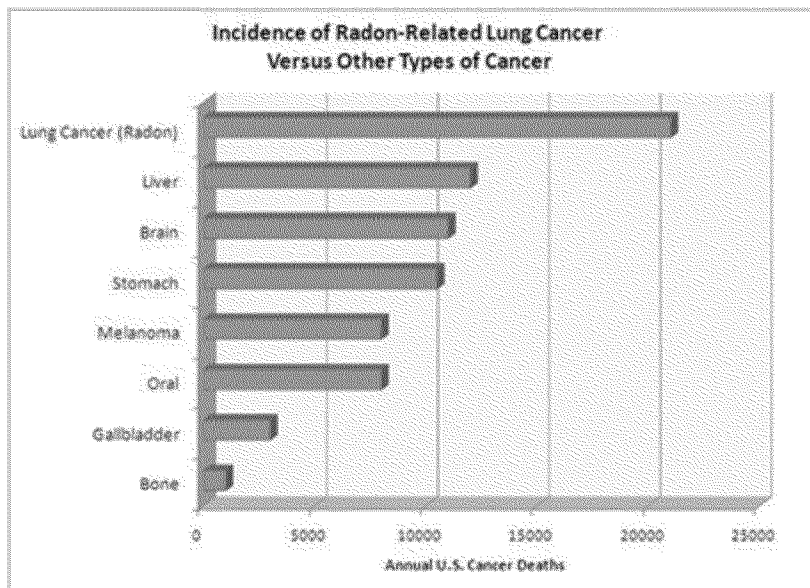
containing radon and its decay products. water for example, is much smaller than

When radon is inhaled, the alpha particles from its lung tissue causing damage that can lead to lung cancer if it is exhaled. The radon dose comes largely from the lungs on dust particles that lodge in the airways quickly, exposing lung tissue to damage and producing the lung tissue.

radioactive decay directly strike sensitive tissue. However, since radon is a gas, most from radon's decay products. They enter the lungs. These radon nuclei decay into other radon nuclei that continue

There is no safe level of radon; any exposure poses some risk of cancer. The National Academy of Sciences (NAS) studied and reported on the causes of lung cancer in two 1999 reports. They conclude that radon is now the second leading cause of lung cancer in the U.S. after cigarette smoking.

The NAS estimates that 15,000-22,000 Americans die every year from radon-related lung cancer. When people who smoke are exposed to radon as well, the risk of developing lung cancer is significantly higher than the risk of smoking alone. The chart at right compares lung cancer cases caused by radon to the incidence of other



forms of cancer.

The NAS also estimates that radon in drinking water causes an additional 180 cancer deaths per year. However, almost 90% of those deaths were from lung cancer caused by inhaling radon released to the air from water. Only about 10% of the deaths were from cancers of internal organs, mostly the stomach, caused by ingesting radon in water.

Is there a medical test to determine exposure to radon?

Several decay products can be detected in urine, blood, or lung and bone tissue. However, these tests are not generally available through typical medical facilities. Also, they cannot be used to determine accurate exposure levels, since most radon decay products disappear within a few hours.

The best way to assess exposure to radon is by measuring concentrations of radon (or radon decay products) in the air you breathe at home.

Protecting People from radon

How do I know if there is radon in my home?

You cannot see, feel, smell, or taste radon. Testing your home is the only way to know if you and your family are at risk from radon. EPA and the Surgeon General recommend testing for radon in all homes below the third floor. EPA also recommends testing in schools.

Radon testing is inexpensive and easy to do. It should only take a few minutes of your time. Millions of Americans have already tested their homes for radon. Various low-cost, do-it-yourself test kits are available through the mail and in hardware stores and other retail outlets. You can also hire a trained contractor to do the testing for you.

More Info

- EPA Citizen's Guide to Radon

This booklet describes commonly available tests for measuring radon concentrations in the home. (See "What's EPA Doing About Radon?")

- Who Can Test for Radon in Your Home

This page provides contacts for help in finding qualified professionals and do-it-yourself test kits.

What can I do to protect myself and my family from radon?

The first step is to test your home for radon, and then have the fixes at or above EPA's Action Level of 4 picocuries per liter. You may want to take action if the levels are in the range of 2-4 picocuries per liter. Generally, levels can be brought below 2 pCi/l fairly simply.

The best method for reducing radon in your home will depend on how radon enters your home and the design of your home. For example, sealing cracks in floors and walls may help to reduce radon, but is not sufficient. There are also systems that remove radon from the crawl space or from beneath the concrete floor or basement slab that are effective at keeping radon from entering your home. These systems are simple and don't require major changes to your home. Other methods may be necessary.

People who have private wells should test their well water to ensure that radon levels meet EPA's proposed standard.

More Info

- Radon in Drinking Water

This page provides information on regulations, studies, and state contacts related to radon in drinking water.

- Radon

This page provides access to a wide variety of information and publications on radon and preventing exposure to radon.

- National Radon Hotline:

800.767-7236

What recommendations has the federal government made to protect human health from radon?

Since 1988, EPA and the U.S. Surgeon General have issued Health Advisories recommending that all homes be tested below the threshold for radon. They also recommend fixing homes with radon levels at or above 4 picocuries per liter (pCi/L), EPA's National Voluntary Action Level. EPA and the Surgeon General also recommend that schools nationwide be tested for radon.

More Info

- EPA Radon Publications, including:
 - EPA's "A Citizen's Guide to Radon"
 - Consumer's Guide to Radon Reduction

What is EPA doing about radon?

EPA has established a voluntary program to promote radon awareness, testing, and reduction. The program sets an 'Action Level' of 4 picocuries per liter (pCi/L) of air for indoor radon. The action level is not the maximum safe level for radon in the home. However, the lower the level of radon, the better. Generally, levels can be brought below 2 pCi/L fairly simply.

In addition to working with homeowners, EPA is working with home builders and building code organizations. The goals are to help newly constructed homes be more radon resistant and to encourage radon testing when existing homes are sold.

More Info

- Radon Resistant New Construction
This page provides information on radon resistant homes.
- Radon and Real Estate
You will find a number of tools and resources used by the real estate community that EPA and its radon partners have developed.

The 1988 Indoor Radon Abatement Act authorizes EPA to provide grants to states to support testing and reducing radon in homes. With various non-governmental and public health organizations, EPA promotes awareness and reduction of indoor radon. Partners include the American Lung Association, the National Environmental Health Association, the American Society of Home Inspectors, and others. The page, Radon Publications and Resources, provides a list of EPA-sponsored publications in English and Spanish.

EPA has also proposed a standard for the maximum amount of radon that may be found in drinking water from community water systems using groundwater.

More Info

- Propose Radon Rule
This rule proposes maximum contaminant levels in drinking water.
- Indoor Radon Abatement Act
This act provides grants to states to support the reduction of radon in homes.
- Radon Publications and Resources
This is a list of EPA-sponsored publications in English and Spanish.

Programs · Topcs · References

ATTACHMENT B

WESTON FLDS

FLD 02 INCLEMENT WEATHER

Hot weather (ambient temperatures over 70°F), cold weather (ambient temperatures below 40°F), rain, snow, ice, and lightning are examples of inclement weather that may be hazardous or add risk to work activities. Extremes of heat, cold, and humidity, as well as rain, snow, and ice, can adversely affect monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials.

RELATED FLDs AND OP

FLD 05 – Heat Stress Prevention and Monitoring

FLD 06 – Cold Stress

OP 05-03-008 – Inclement Weather & Business Disruption Policy

PROCEDURE

The potential for exacerbating the impact of physical hazards must be considered for tasks that expose personnel to inclement weather. Risk assessment and hazards analysis should be accomplished during the planning stages of a project for the most likely inclement weather conditions that may be encountered, i.e., rain and lightning in late spring, summer, and early fall, or lightning prone areas; cold, snow, and ice in winter. The Field Safety Officer (FSO) must determine the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his/her work and be actively alert to these hazards. Managers and workers must be familiar with the requirements of FLD 05 and FLD 06.

A pre-site activity risk assessment must be completed when inclement weather occurs. Weather conditions that affect instruments and personal protective equipment (PPE) function must be conveyed to site workers who should monitor function and integrity of PPE and be alert to changing weather conditions. A decision must be made on the proper safety procedures to use if work must continue, or to stop work if the risk is too great. The appropriate Safety Professional **must be notified of all instances of the need to stop work for safety reasons, including inclement weather.**

Heat

Hot, dry weather increases risk of soil drying, erosion, and dust dispersion, which may present or increase risk of exposure and environmental impact from toxic hazards. Hot weather will increase pressure on closed containers and the rate of volatilization, thereby potentially increasing the risk of exposure to toxic, flammable, or explosive atmospheres.

Prevention and Protective Measures

Employees must be protected from airborne contaminants using engineering controls such as wetting dry soil to prevent particle dispersion, and providing local ventilation to reduce volatile air contaminants to safe levels, or if engineering controls are infeasible, using prescribed PPE. Wind shifts and velocity should be measured where change may result in dispersion of airborne contaminants into the work area.

Rain, Wet Weather, and High Humidity

Wet conditions resulting from rain and wet weather increase slipping and tripping hazards, braking distances of vehicles, the potential for vehicle skidding, or difficulties in handling powered devices such as augers and drills. Rain fills holes, obscures trip and fall hazards, and increases risk of electrical shock

when working with electrical equipment. Changes in soil conditions caused by rain can impact trenching and excavating activities, creating the potential for quicksand formation, wall collapse, and cave-in. Vehicles become stuck in mud, and tools and personnel can slip on wet surfaces. Rain and wet conditions may decrease visibility (especially for personnel wearing respiratory protection) and limit the effectiveness of certain direct-reading instruments (e.g., photoionization detectors [PIDs]).

Feet that become wet and are allowed to remain wet can lead to serious problems under both heat and cold conditions. Activities that may result in wet feet include extended work in chemical protective clothing and wading in water/liquid during biological assessments. Trench foot, paddy foot, and immersion foot are terms associated with foot ailments resulting from feet being wet for long periods of time. All have similar symptoms and effects. Initial symptoms include edema (swelling), tingling, itching, and severe pain. These may be followed by more severe symptoms including blistering, death of skin tissue, and ulceration. (NOTE: The following Preventive and Protective Measures also apply to Cold, Snow, and Ice.)

Preventive and Protective Measures

Walkways, stairs, ladders, elevated workplaces, and scaffold platforms must be kept free of mud, ice, and snow. Employees shall be prohibited from working on scaffolds covered with snow, ice, or other slippery material except as necessary for removal of such materials.

Vehicles used in rain or cold weather must have working windshield wipers and defrosters, and windows must be kept clear of obstruction.

Drivers must observe traffic laws, including maintaining speed within limits safe for weather conditions, and wearing seat belts at all times. Note that this may mean operating below the posted speed limit.

When walking, workers should use a walking stick or probe to test footing ahead where there is standing water, snow, or ice to protect the walker against stepping into potholes or onto puncture hazards, buried containers, or other potential structurally unsound surfaces.

Prior to using vehicles or equipment in off-road work, workers should walk the work area or intended travelway when puddles or snow may obscure potholes, puncture hazards, or buried containers, or other potential structurally unsound surfaces.

Project managers should arrange to have winches, come-alongs, or other mechanical assistance available when vehicles are used in areas where there is increased risk of getting stuck. Cable or rope and mechanical equipment used for pulling stuck vehicles must be designed for the purpose, of sufficient capacity for the load, and be inspected regularly and before use to ensure safety. **Manually pushing stuck vehicles is to be avoided.**

Prevention methods are required when work is performed in wet conditions or when conditions result in sweating, causing the feet to become and remain wet. Proper hygiene is critical. Workers must dry their feet and change socks regularly to avoid conditions associated with wet feet. Use of foot talc or powder can additionally assist in prevention of this type of condition.

Cold, Snow, and Ice

Cold weather affects vehicle operation by increasing difficulty in starting and braking. Ice, frost, and snow can accumulate on windows and reduce vision. Cold, wet weather can cause icing of roadways,

driveways, parking areas, general work places, ladders, stairs, and platforms. Ice is not always as obvious to see as snow or rain, and requires special attention, especially when driving or walking.

Snow and ice increase the risk of accidents such as slipping when walking, climbing steps and ladders, or working at elevation, and the risk of accidents when driving vehicles or operating heavy equipment. Heavy snow and ice storms may cause electric lines to sag or break, and the use of electrical equipment in snow increases the risk of electric shock. Snow can hide potholes and mud, which can result in vehicles getting stuck or persons falling when stepping into hidden holes. Snow also may cover water, drums or other containers, sharp metal objects, debris, or other objects that can cause falls or punctures.

Preventive and Protective Measures

WESTON personnel are cautioned against operating motor vehicles such as cars or trucks on ice under any circumstances. If traveling in icy conditions, WESTON personnel should follow all public service advisories that curtail driving activities.

Personnel performing activities that require working over ice should be aware of minimal ice thickness safety guidelines as follows:

- Y 4-inch minimum: activities such as walking or skating.
- Y 6-inch minimum: activities such as snowmobiling or the use of equipment with the same weight and cross-sectional area as a snowmobile.

Personnel should always be aware that these measurement guidelines are under ideal conditions and that snow cover, conditions on rivers, ponds, or lakes with active currents, and other environmental factors impact the safety of working on ice. Clear ice typically is the strongest, while ice that appears cloudy or honeycombed (contains entrained air) is not as structurally strong. Measurements made by drilling or cutting through the ice should be made every few feet to verify safe conditions. Provisions for rescue (e.g., ladders or long poles and effective communications) must be available at the work site.

Lightning

Lightning represents a hazard of electrical shock that is increased when working in flat open spaces, elevated work places, or near tall structures or equipment such as stacks, radio towers, and drill rigs. Lightning has caused chemical storage tank fires and grass or forest fires. Static charges associated with nearby electrical storms can increase risk of fire or explosion when working around flammable materials, and can adversely affect monitoring instruments.

Lightning is the most dangerous and frequently encountered weather hazard people experience each year. Lightning affects all regions. **Florida, Michigan, Pennsylvania, North Carolina, New York, Ohio, Texas, Tennessee, Georgia, and Colorado** have the most lightning deaths and injuries.

Preventive and Protective Measures

Prior to working in areas or beginning projects when or where there is an increased potential for lightning striking personnel, steps must be taken to predict the occurrence of lightning strikes. Recommendations include:

- Y Check with client management to determine if there are any patterns or noted conditions that can help predict lightning or if there are structures that are prone to lightning strikes. Arrange for

client notification when there is increased potential for lightning activities. Ensure that clients include WESTON workers in lightning contingency plans.

- Y Monitor weather reports.
- Y Note weather changes and conditions that produce lightning.
- Y Stop work in open areas, around drill rigs or other structures that may attract lightning, on or in water and in elevated work places when lightning strikes are sighted or thunder is heard near a work site.
- Y Ensure all personnel are provided with safe areas of refuge. Prevent personnel from standing in open areas, under lone trees, or under drill rigs.
- Y Observe the “30-30” Rule. If you see lightning and thunder is heard within 30 seconds (approximately 6 miles), seek shelter. If you hear thunder, but did not see the lightning, you can assume that lightning is within 6 miles and you should seek shelter. Remain in the sheltered location for 30 minutes following the last lightning strike.
- Y Use a hand held static potential meter (lightning detection device) to monitor the potential difference between a cloud and the ground. When the measured potential is greater than 2 kV/m, there is a potential for a lightning strike – seek shelter.

High Wind and Tornado Safety

High Winds

Many construction workers have died due to wind-related accidents and injuries. A ladder that seems secure under normal circumstances can become unstable during windy conditions and cause you to fall. Scaffolding that is improperly secured can rip free during strong winds and kill bystanders. The risk of injury for construction workers increases during strong winds. Keep in mind that changing weather conditions can affect your daily work tasks, and make sure you have a game plan to prevent proper damage and personal injury.

Stay Informed: With today’s modern technology available at the touch of a button, you should keep up to date with the latest local weather reports. Visit weatherbug.com or weather.gov to stay informed in case of wind warnings, watches, and advisories. Larger projects may have their own weather station on site to provide instant weather data. Use daily hazard assessments to determine if working conditions have changed or will change throughout the day.

Be Prepared: When you know the weather will be windy, secure loose building materials, scaffolding and fencing that could be picked up or torn loose by strong winds and thrown onto surrounding streets, structures, vehicles, or bystanders.

Know the Limits of Your Equipment: When operating any equipment, take time to read the operator’s manual and become familiar with the wind specifications. Many crane manufacturers have high-wind guidelines to prevent you from operating a crane in unsafe weather. You should also check safety equipment such as fall protection to determine if it is adequate for windy conditions.

Know the Terminology

Severe Thunderstorm Watch

A Severe Thunderstorm Watch means that strong thunderstorms capable of producing winds of 58 mph or higher and/or hail 3/4 inches in diameter or larger are possible. If you are in the area of a Severe Thunderstorm Watch, you should be prepared to take shelter from thunderstorms. Severe Thunderstorm Watches are generally issued for 6-hour periods.

Severe Thunderstorm Warning

A Severe Thunderstorm Warning means that thunderstorms capable of strong winds and/or large hail are occurring or could form at any time. If you are in the area of a severe thunderstorm, you should take shelter indoors immediately, avoid windows, and be prepared for high winds and hail. Severe Thunderstorm Warnings are generally in effect for an hour or less.

High Wind Watch

A High Wind Watch is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are likely to develop in the next 24 to 48 hours. For summit areas, high wind watches are issued when sustained winds are expected to exceed 45 mph and/or frequently gust over 60 mph. If you are in an area for which a High Wind Watch has been issued you should secure loose objects outdoors that may blow about and avoid outdoor activity that exposes you to high winds.

High Wind Warning

A High Wind Warning is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are occurring or imminent. For summit areas, warnings are issued for winds exceeding 45 mph and/or frequently gusting over 60 mph. Wind warnings may issued up to 24 hours ahead of the onset of high winds and remain in effect for 6 to 12 hours. If you are in an area where a high wind warning is in effect you should avoid activities that expose you to high winds. Loose objects may be blown around. Tree limbs may break and fall. Power lines may be blown down.

Wind Advisory

A Wind Advisory is issued when sustained winds of 30 to 39 mph and/or frequent gusts to 50 mph or greater are occurring or imminent. Wind advisories may be in effect for 6 to 12 hours. If you are in an area where a wind advisory is in effect you should secure loose objects that may be blown about outdoors and limit activity that may expose you to high winds.

Work Safely: If you will be working on a windy day, you should be alert and protected. Wear eye protection to prevent dust and other particles from entering or striking your eyes. Keep your hard hat on at all times to prevent injuries from falling or flying objects. The likelihood of falls from heights is greatly increased by strong winds. Wear the necessary PPE to ensure your safety.

To avoid flying debris and to minimize damage during high winds:

- Y Shut down outdoor activities involving work at elevation on ladders, scaffolding, aerial lifts, etc.; handling large tarps and plastic sheeting when wind speeds exceed 25 mph; including work with radioactive materials and highly toxic materials that could be dispersed by the winds.
- Y At 13 - 18 mph wind will raise dust. Follow the dust action level.

- Y Move mobile items stored outside to indoor storage.
- Y Secure any items that cannot be moved inside.
- Y Be careful opening exterior doors.
- Y Be cautious about downed power lines, tree limbs, and debris on roads.
- Y Be alert for animals who have escaped from farms and zoos.

Stay Away from Power Lines: High winds can cause tree limbs to fall on power lines resulting in electrocution hazards or loss of power. Your best bet is to keep your distance.

Tornados

What is a TORNADO?

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm or as a result of severe weather associated with hurricanes. A funnel cloud is formed as cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado results from high wind velocity and wind blown debris.

Tornado Safety

When a tornado approaches, you have only a brief amount of time to make life-or-death decisions. Advance planning and quick response are the keys to surviving a tornado.

Purchase a NOAA Weather Alert radio with an alert feature. When tuned to the proper frequency, these weather radios remain silent until a weather emergency occurs. Once they pick up the alarm tone, they will begin broadcasting emergency weather information so that citizens can protect themselves and their property. Some models of the NOAA weather radio incorporate the Specific Area Message Encoder technology, allowing users to target only those warnings that affect their immediate geographic area.

Conduct tornado drills. Designate an area to serve as your safe area, and practice having team members assemble there in response to a mock tornado warning.

Emergency Communications Plan. Develop an emergency communications plan in case team members are separated from one another when a tornado warning goes into effect. Designate an emergency coordinator. Instruct everyone to contact this coordinator in a weather emergency for instructions on what to do during the storm and where to reassemble after the emergency has passed. Design contingency plans to be consistent with client contingency plans. When possible use client warning and alerting systems and confirm that team members have access to shelters and know how to get to them.

Know the Difference between a Tornado Watch and a Tornado Warning

Tornado Watch: Issued by the National Weather Service when tornadoes are possible in your area. You should remain alert for approaching storms. Remind family members of where the safe areas are within your home, and carefully monitor radio or television reports for further developments.

Tornado Warning: Indicates that a tornado has been sighted in your area, or is indicated on weather radar. You should proceed to safe shelter immediately.

When A Tornado Warning Goes In Effect, Put Your Safety Plans In Action.

In Your Automobile: Motor vehicles are easily overturned by tornado winds. Leave your vehicle and seek shelter in a sturdy building. As a last resort, seek shelter in a ditch or culvert. Do not try to outrun or outmaneuver a tornado! Use the time to seek appropriate shelter outside your vehicle.

Office Buildings, Hotels, and Shopping Centers: Take shelter in an interior hallway on a lower floor. A closet, bathroom or other small room with short, stout walls will give some protection from collapse and flying debris. Otherwise, get under heavy furniture and stay away from windows. Many tornado deaths have occurred in large buildings due to the collapse of a roof or wide span wall. A corner area, away from a window, is safer than the middle of a wide span wall.

Out In Open Country: When severe weather approaches, seek inside shelter immediately. The chances of encountering falling trees, downed power lines and lightning are far greater than encountering a tornado itself. If a tornado approaches, lie flat in the nearest depression, such as a culvert or ditch, and cover your head with your arms.

BE ALERT TO CHANGING WEATHER CONDITIONS

HAVE AN EMERGENCY WEATHER PLAN IN PLACE

REHEARSE YOUR CONTINGENCY PLANS PERIODICALLY

KNOW WHERE TO GO WHEN A TORNADO THREATENS.

FLD 05 HEAT STRESS PREVENTION AND MONITORING

Heat stress may occur at any time work is performed at elevated temperatures. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur such as fatigue, irritability, anxiety, and decreased concentration or dexterity, and possibly death. Because heat stress is one of the most common and potentially serious illnesses at field sites, regular monitoring and other preventive measures are vital to ensure worker safety. Wearing chemical protective clothing often decreases natural body heat loss (cooling) and increases the risk of heat stress.

Employees who are taking prescription or over-the-counter medications should consult with their personal physician prior to working in high-temperature environments to see if their medication would impair their ability to handle heat stress.

REFERENCES

OSHA 29 CFR 1910 and 1926

RELATED FLDs

FLD 02 – Inclement Weather

FLD 03 – Hot Processes – Steam, Low Temperature Thermal Treatment Unit, and Transportable Incinerator

FLD 08 – Confined Space Entry Program

FLD 36 – Welding/Cutting/Brazing/Radiography

FLD 37 – Pressure Washers/Sandblasting

PROCEDURE

Heat Stress Symptoms and Treatment

Heat Rash

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation and is aggravated by chafing clothes. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impairs a worker's performance.

Symptoms – Mild red rash, especially in areas of the body that come into contact with protective gear.

Treatment – Decrease amount of time spent working in protective gear and provide body powder to help absorb moisture and decrease chafing. Heat rash can be prevented by showering, resting in a cool place, and allowing the skin to dry.

Heat Cramps

Heat cramps are caused by inadequate electrolyte intake. The individual may be receiving adequate water; however, if not combined with an adequate supply of electrolytes, the blood can thin to the point where it seeps into the active muscle tissue, causing cramping.

Symptoms – Acute painful spasms of voluntary muscles, most notably the abdomen and extremities.

Treatment – Move the victim to a cool area and loosen clothing. Have the victim drink 1 to 2 cups of cool potable water or diluted commercial electrolyte solution (e.g., Gatorade, Quench) immediately, and then every 20 minutes thereafter until symptoms subside. Electrolyte supplements can enhance recovery; however, it is best to double the amount of water required by the dry mix package directions or add water to the liquid form.

Heat Exhaustion

Heat exhaustion is a state of weakness or exhaustion caused by the loss of fluids from the body. Heat exhaustion is not as dangerous as heat stroke, but if not properly managed in the field it may lead to heat stroke.

Symptoms – Pale, clammy, and moist skin, profuse perspiring, and extreme weakness. Body temperature is normal, pulse is weak and rapid, and breathing is shallow. The person may have a headache, may vomit, may feel dizzy, and may be irritable or confused.

Treatment – Move the victim to a cool, air-conditioned or temperature-controlled area, loosen clothing, place in a position with the head lower than the feet (shock prevention), and allow the victim to rest. Consult a physician. Ensure that the victim is not nauseated or vomiting. If not nauseated or vomiting, give the victim small sips of cool water or diluted electrolyte replenishment solution (one to one dilution with water, or if mixing from powder, double the water added). If this is tolerated, have the victim drink 1 to 2 cups of fluid immediately, and every 20 minutes thereafter until symptoms subside. Seek medical attention at the advice of the consulting physician.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the body's heat regulating mechanisms, i.e., the individual's temperature control system (sweating) stops working correctly. Body temperature rises so high that brain damage and death may result if the person is not cooled quickly.

Symptoms – Red, hot, dry skin (although the person may have been sweating earlier); nausea, dizziness, confusion, extremely high body temperature (i.e., 104°F or greater as measured with an oral thermometer), rapid respiratory and pulse rate, seizures or convulsions, unconsciousness or coma.

Treatment – Immediately call for emergency medical assistance. Remove the victim from the source of heat and cool the victim quickly. If the body temperature is not brought down quickly, permanent brain damage or death may result. Remove all PPE and as much personal clothing as decency permits. Fan the person while sponging or spraying with cool or tepid water. Apply ice packs (if available) to the back of the neck, armpits, groin area, or behind the knees. Place the victim flat on their back or with head and shoulders slightly elevated. If conscious, and not nauseated or vomiting, the victim may be provided sips of cool water. Do not give the victim coffee, tea, or alcoholic beverages. Emergency medical personnel will take over treatment when they arrive.

Recognition and Risk Assessment

In the planning stages of a project, the potential for heat stress disorders must be considered as a physical hazard in the site-specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP the most likely heat stress disorders that may occur. The Field Safety Officer (FSO) must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not

followed or the risk is too great. In addition, all site personnel must be aware of these symptoms in both themselves and their co-workers.

Prevention and Protection Programs

Heat stress is affected by several interacting factors including, but not limited to, age, obesity, physical condition, substance abuse, level of personal protective equipment (PPE) worn, and environmental conditions (temperature, shade, and humidity). Site workers must learn to recognize and treat the various forms of heat stress. The following recommendations should be followed to prevent heat stress:

- Y The most important measure to prevent heat-related illness is adequate fluid intake. Workers should drink 1/2 to 1 quarts of liquids per hour in high heat conditions. Most of this liquid should be water. Under heavy work and heat conditions, the body may lose up to 2 gallons of fluids per day. To prevent heat stress symptoms, the individual must ensure replacement of this fluid.
- Y Provide disposable cups that hold about 4 ounces, and water that is maintained at 50 to 60°F. Workers should drink 16 ounces of water before beginning work, and a cup or two at each break period.
- Y Provide a shaded area for rest breaks. Ensure that adequate shelter is available to protect personnel against heat and direct sunlight. When possible, shade the work area.
- Y Discourage the intake of caffeinated drinks during working hours.
- Y Monitor for signs of heat stress.
- Y Encourage workers to maintain a good diet during these periods. In most cases, a balanced diet and lightly salted foods should help maintain the body's electrolyte balance. Bananas are especially good for maintaining the body's potassium level.
- Y If utilizing commercial electrolyte mixes, double the amount of water called for in the package directions. Indications are that "full-strength" preparations taken under high heat stress conditions may actually decrease the body's electrolytes.
- Y Acclimate workers to site work conditions by slowly increasing workloads (i.e., do not begin work activities with extremely demanding tasks).
- Y Rotate shifts of workers who are required to wear impervious clothing in hot weather.
- Y Encourage workers to wear lightweight, light-colored, loose-fitting clothing.
- Y In extremely hot weather, conduct field activities in the early morning and evening.
- Y Provide cooling devices to aid natural body heat regulation. These devices, however, add weight and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear, which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- Y Good hygienic standards must be maintained by frequent showering and changes of clothing.
- Y Clothing should be permitted to dry during rest periods.
- Y Whenever working in the sun, provide employees with sunscreen with both UVA and UVB protection.
- Y Persons who notice skin problems should immediately consult medical personnel.

Heat Stress Monitoring and Work Cycle Management

When strenuous field activities are part of on-going site work conducted in hot weather, the following guidelines should be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures should be instituted when the temperature exceeds 70°F and the tasks/risk analysis indicates an increased risk of heat stress problems. Consult the HASP and a safety professional (e.g., Division EHS Manager, FSO) if questions arise as to the need for specific heat stress monitoring. In all cases, the site personnel must be aware of the signs and symptoms of heat stress and provide adequate rest breaks and proper aid as necessary.

Measure Heart Rate – Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the rest period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the heart rate is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats per minute.

Measure Body Temperature – When ambient temperatures are over 90°F, body temperatures should be measured with a clinical thermometer as early as possible in the rest period. If the oral temperature exceeds 99.6°F (or 1 degree change from baseline) at the beginning of the rest period, the following work cycle should be shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F (or 1 degree change from baseline). Under no circumstances should a worker be allowed to work if their oral temperature exceeds 100.6°F.

Measure Body Water Loss – Body water loss greater than 1.5% of total body weight is indicative of a heat stress condition. Body weight is measured before PPE is donned and after the PPE is removed following a work cycle. Body water loss can be measured with an ordinary bathroom scale; however, the scale must be sensitive to one-half pounds increments. A worker is required to drink additional fluids and rest if their body water loss is greater than 1.5%.

NOTE: For purposes of this operating practice, a break is defined as a 15-minute period and/or until an individual's vital signs are within prescribed guidelines.

A physiological monitoring schedule is determined by following the steps below:

- Y Measure the air temperature with a standard thermometer.
- Y Estimate the fraction of sunshine by judging what percent the sun is out (refer to Table 1).
- Y Calculate the adjusted temperature based on the following formula:
$$\text{Adjusted Temperature} = \text{Actual Temperature} + 13 \times X \text{ (where } X = \text{sunshine fraction from Table 1)}$$
- Y Using Table 2, determine the physiological monitoring schedule for fit and acclimated workers for the calculated adjusted temperature.

The length of work period is governed by frequency of physiological monitoring (Table 2). The length of the rest period is governed by physiological parameters (heart rate and oral temperature).

**Table 1. Percent Sunshine Factors
Heat Stress Prevention and Monitoring**

Percent Sunshine (%)	Cloud Cover	Sunshine fraction
100	No cloud cover	1.0
50	50% cloud cover	0.5
0	Full cloud cover	0.0

**Table 2. Physiological Monitoring Schedule
Heat Stress Prevention and Monitoring**

Adjusted Temperature	Level D (Permeable clothing)	Level C, B, or A (Nonpermeable clothing)
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° - 87.5°F (28.1° - 32.2°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° - 82.5°F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° - 77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Example: Site personnel anticipate wearing level C (impermeable clothing) during site activities. The air temperature is 80°F and there are no clouds in the sky (100% sunshine). The adjusted temperature is calculated in the following manner:

$$\text{Adjusted Temperature (Adj T } ^\circ\text{F)} = \text{Actual Temperature (Amb T } ^\circ\text{F)} + (13 \times \text{sunshine fraction})$$

$$\text{Adj T } ^\circ\text{F} = 80^\circ\text{F} + (13 \times 1.0)$$

$$\text{Adj T } ^\circ\text{F} = 93^\circ\text{F}$$

Using Table 2, the pulse rate, oral temperature and body water loss monitoring would be conducted after each 15 minutes of work. The adjusted temperature may need to be redetermined if the percent sunshine and ambient temperature changes drastically during site work.

If an individual's heart rate exceeds 110 beats per minute at the beginning of the rest period, that individual will continue to rest until his or her heart rate drops to baseline; the next work period is then decreased by 33%.

FLD 11 ROUGH TERRAIN/ATV USE

RELATED FLDs

FLD 02 – Inclement Weather

FLD 05 – Heat Stress Prevention and Monitoring

FLD 06 – Cold Stress

FLD 22 – Heavy Equipment Operation

FLD 47 – Clearing, Grubbing, and Logging Operations

FLD 57 – Motor Vehicle Safety

HAZARD

Physical hazards associated with rough terrain include vehicle accidents, heavy equipment incidents, falling, slipping, and tripping.

Driving vehicles on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches, or of an accident due to flat tires or striking obstacles and other vehicles.

When working on foot, steep inclines and heavy or downed vegetation can hide holes or breaks in the terrain, increasing the risk of slips, trips, and falls.

RECOGNITION AND RISK ASSESSMENT

Rough terrain complicates work activities and adds to or increases risk. In the planning stages of a project, rough terrain must be considered as a physical hazard and identified in the site-specific health and safety plan (HASP). Risk assessment is usually accomplished from site history information (i.e., site topography) and on site by the Field Safety Officer (FSO).

HAZARD PREVENTION AND PROTECTION PROGRAMS

Safety on Foot

Personnel working on rough terrain should maintain a high level of physical conditioning due to increased body stress and exertion.

The site crew should be alert and observe terrain while walking to minimize slips, trips, and falls.

Boots should be ankle high or higher to provide additional support and stability.

Work will be completed in adequate natural light or sufficient illumination will be maintained.

Site personnel will conduct an initial walkover and the “buddy system” will be implemented.

Emergency communications such as a cell phone or two-way radio should be carried at all times.

Personnel should be aware of potential hazards and ensure the availability of first-aid supplies and knowledge of the location of the nearest medical assistance.

VEHICLE SAFETY

Vehicle drivers and passengers will wear seatbelts at all times.

Hazards can be prevented by ensuring regular maintenance is performed on vehicles and all safety features are working. Have brakes and wheel bearings of vehicles used off road or in four wheel drive inspected at increased frequency (suggest inspections at twice the manufacturer's recommended frequency).

In order to minimize accidents, site surveillance on foot may be required to ensure clear driving paths.

Minimize side hill travel. Travel straight up and down hills whenever possible. Passengers will not be allowed when side hill travel is required.

Take into account loads or superstructure of vehicles which raise the center of gravity and increase risk of tipping.

Cross streams, small logs or other passable (there is adequate clearance of the undercarriage) obstructions at right angles.

Four wheel drive vehicles should be used if terrain conditions are wet, frozen, broken, or otherwise deemed unsafe for two wheel drive vehicles by the FSO. Use of vehicles off-road will be specifically addressed in the HASP and personnel operating vehicles will be checked for proficiency.

- Y Before moving a vehicle in the field, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.
- Y Always check the brakes of a vehicle before traveling, particularly on rough, uneven, or hilly ground.
- Y Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Y Engage the all wheel drive when traveling off highway on hilly terrain.
- Y Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Y Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- Y After the vehicle/equipment has been moved to a new site, set all brakes and/or locks. When grades are steep, block the wheels.

Definitions

Class I, All-terrain vehicle (ATV): A motorized off-highway vehicle, 50 in. (127 cm) or less in width, having dry weight of 800 lbs (362.9 kg) or less, and traveling on three or more low pressure tires (10 lbs [4.5 kg] psi or less), with a seat designed to be straddled by the operator.

Class I, Category G, ATV: An ATV intended for general recreational and utility use.

Class I, Category U, ATV: An ATV intended primarily for utility use.

Class II, ATV: A motorized off-highway vehicle with a width which exceeds 50 in. (127 cm) or having a dry weight that exceeds 800 lbs (362.9 kg), traveling on four or more low-profile, low-pressure tires (10 lbs [4.5 kg] psi or less) and having a bench seat.

NOTE: Utility Vehicles are designed to perform off-road utility tasks such as passenger and cargo transportation and are addressed separately below. Examples are Rangers, Rhino, M-Gators, Gators, and Mules.

Rollover Protective Structure (ROPS). A cab or frame that provides a safe environment for the tractor operator in the event of a rollover.

ALL TERRAIN VEHICLES (ATVS)

Qualifications

ATV operators will have completed a nationally recognized accredited ATV training course (such as provided by the Specialty Vehicles Institute of America or in-house resources that have been certified as trainers by an accredited organization) prior to operation of the vehicle.

The operator must pass an operating skills test prior to being allowed to operate an ATV. Proof of completion of this training will be maintained.

Equipment

All ATVs shall be equipped with:

- Y An operable audible warning device (horn);
- y Headlights (if it will be used during hours of darkness);
- y Taillights; and
- y Brake lights.
- y Mufflers and spark arresters.

All Class II ATVs will be equipped with ROPS and seatbelts

Operation

Only Class I and Class II ATVs with four or more wheels may be used. Class III ATV's may not be used.

The manufacturer's recommended payload will not be exceeded at any time.

Gloves and an approved motorcycle helmet with full-face shield or goggles will be worn at all times while operating a Class I ATV.

An ATV will not be driven on public roadways except to cross the roadway, and it will only be driven on a public roadway at designated crossing points or with a road guard (no paved road use unless allowed by the manufacturer).

A copy of the operator's manual will be kept on the vehicle and protected from the elements (if practicable).

Tires shall be inflated to the pressures recommended by the manufacturer.

Passengers are prohibited on Class I ATVs.

UTILITY VEHICLES

Utility vehicles are defined as specialty Class II ATVs designed to perform off-road utility tasks such as passenger and cargo transportation. Examples are Rangers, Rhino, M-Gators, Gators, and Mules.

Utility vehicle operators shall be trained and familiar with the use of all controls; understand proper moving, stopping, turning and other operating characteristics of the vehicle. Operators must review all training materials provided by the manufacturer for the specific vehicles, and training should be in accordance with appropriate manufacturer recommendations. A copy of the operator's manual shall be kept on the vehicle at all times and protected from the elements. At a minimum, training should address:

- Y Basic riding tips from the manufacturer's published literature for each vehicle.
- Y Reading terrain.
- Y Climbing hilly terrain.
- Y Descending a hill.
- Y Traversing a slope.
- Y Riding through water.
- Y Cargo carriers and accessories.
- Y Loading and unloading.
- Y Troubleshooting.
- Y Proper preventative maintenance, (i.e., oil levels, tire pressure requirements and scheduled maintenance requirements according to the manufacturer's guidelines.).

Utility vehicles shall be equipped with:

- Y Operable audible warning device (horn).
- y Headlights.
- y Taillights.
- y Brake lights.
- y Seatbelts.
- y ROPS.

Occupancy in utility vehicles is limited to manufacturer designated seating that has built-in seatbelts. Passengers may not ride in the vehicle's back cargo area unless the vehicle is otherwise equipped. Note: When used for emergency response, medical litters may be placed in the back cargo area but must be secured as described below.

The manufacturer's recommended load carrying capacity, personnel capacity, or maximum safe vehicle speed shall not be exceeded at any time.

Cargo items will be secured as necessary to prevent movement/tipping. All loads over fifty pounds (to include medical litters) must be securely strapped to cargo tie-downs in the rear and to the cargo shelf in the front.

Seatbelts will be worn by operators and passengers of specialty vehicles where installed by the manufacturer. Operators and passengers shall wear goggles at all times when a utility vehicle, not equipped with a windshield, is in motion.

Utility vehicles will not normally be driven on public roadways except to cross the roadway, and will only be driven on a public roadway at designated crossing points or with a road guard. Utility vehicles that are allowed to operate outside a controlled work area and/or on public roads will meet the minimum vehicle safety standards in accordance with 49 CFR 571.5, to include ROPs, seatbelts and placement of “Slow Moving Vehicle” emblems where required.

Manufacturer-installed safety equipment will be maintained in working order and used in compliance with the requirement of this regulation and in accordance with manufacturer’s recommendations.

RULES

Observe the following practices to help prevent accidents:

- Y Do not misuse utility vehicles.
- Y Reduce speed and exercise extreme caution on slopes or on rough ground.
- Y Do not overload vehicle and avoid shifting loads. Reduce load when operating over rough or hilly terrain.
- Y Do not stop or start suddenly when going uphill or downhill. Be especially cautious when changing direction on slopes.
- Y Stay alert for holes, rocks, and other hidden hazards in the terrain.
- Y Keep away from drop-offs, ditches, embankments, as well as ponds and other bodies of water. The machine could suddenly turn over if a wheel is over the edge of a cliff or ditch, or if an edge caves in.
- Y Keep front wheels straight at crest of hill or going over bumps.
- Y When descending a hill, remove foot from accelerator and apply brakes to reduce speed and maintain control.

Transport Loads Safely

- Y Be sure load is evenly distributed.
- Y Do not load above the load guard.
- Y Securely anchor all loads in cargo box.
- Y Reduce cargo box capacity when operating on rough or hilly terrain.
- Y Use existing trails. Avoid terrain such as dangerous slopes and impassable swamps. Watch carefully for sharp bumps, holes, ruts, or obstacles.
- Y Look ahead at terrain. Know what is coming and be prepared to react. Be alert for hazards.
- Y Keep front wheels straight at the crest of a hill or going over bumps.
- Y Reduce speed according to trail, terrain, and visibility conditions.
- Y The passenger should always use the hand holds.

Climbing or Descending a Hill

- Y Always use the brakes when going down slopes, the utility vehicle can speed up (freewheel) going down a slope. Engine or clutch braking effect is minimal.
- Y Balance loads evenly and secure them. Braking could shift the load and affect vehicle stability.
- Y Sit on the center of the seat and keep both feet within the foot platform.
- Y Never drive past the limit of visibility. Slow down near the crest of a hill until getting a clear view of the other side.
- Y If the vehicle stops or loses power going up a hill, lock the park brake to hold the vehicle on slope. Maintain direction of travel and release the brake slowly. Back straight down hill slowly while maintaining control. Do not turn the vehicle sideways. The vehicle is more stable in a straight forward or rearward position.
- Y If the utility vehicle begins to tip, turn the front wheel downhill to gain control before proceeding.

Riding Through Water

- Y Avoid water whenever possible. If the drive belt becomes wet, slippage will occur and the vehicle will lose power.
- Y Never cross any body of water where the depth may be unknown to the operator. As an operational guideline, deep water is considered anything in excess of 152 mm (6 in.) in depth. Tires may float, making it difficult to maintain control.
- Y Choose a course within the waterway where both banks have a gradual incline. Cross at a point known to be safe.
- Y Proceed at a slow steady speed to avoid submerged obstacles and slippery rocks.
- Y Avoid water crossings where the operation of a utility vehicle may cause damage to waterway beds or erode waterway shoreline.

FLD 22 EARTH MOVING EQUIPMENT/MATERIAL HANDLING EQUIPMENT

REFERENCES

29 CFR Part 1926 Subparts 600-602

RELATED FLDs

FLD 23 – Cranes, Rigging, and Slings

FLD 24 – Aerial Lifts/Manlifts

FLD 34 – Utilities

FLD 35 – Electrical Safety

PROCEDURE

These rules apply to the following types of earthmoving equipment: scrapers, loaders, crawler or wheel tractors, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.

Machinery and Mechanized Equipment Safety

Before any machinery or mechanized equipment is placed in use, it will be inspected and tested by a competent mechanic and certified to be in safe operating condition.

WESTON will designate a competent person to be responsible for the inspection of all machinery and equipment daily and during use to make sure it is in safe operating condition. Tests will be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.

Preventative maintenance procedures recommended by the manufacturer will be followed.

Any machinery or equipment found to be unsafe shall be removed from service and its use prohibited until unsafe conditions have been repaired or corrected.

Inspections or determinations of road conditions and structures will be made in advance to ensure that clearances and load capacities are safe for the passing or placement of any machinery or equipment.

Machinery and mechanized equipment will be operated only by designated personnel. Equipment deficiencies observed at any time that affect safe operation will be corrected before continuing operation.

Seat belts shall be provided on all equipment covered by this section and shall meet the requirements of the Society of Automotive Engineers (J386-1969) and Seat Belts for Construction Equipment. Seat belts for agricultural and light industrial tractors shall meet the seat belt requirements of Society of Automotive Engineers (J333a-1970), Operator Protection for Agricultural and Light Industrial Tractors.

Seat belts shall be worn when provided by the manufacturer. Passengers shall not be allowed to ride on equipment unless equipment is designed with additional seats with safety belts.

Audible alarms. All bi-directional machines, such as rollers, compacters, front-end loaders, bulldozers, and similar equipment, shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction. The horn shall be maintained in an operative condition.

Getting off or on any equipment while it is in motion is prohibited.

Machinery or equipment requiring an operator will not be permitted to run unattended.

Machinery or equipment will not be operated in a manner that will endanger persons or property, nor will the safe operating speeds or loads be exceeded.

All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. The only exemption is equipment designed to be serviced or maintained while running.

All repairs on machinery or equipment will be made at a location that will provide protection from traffic or other hazards to maintenance personnel.

Machinery and equipment, or parts thereof, that are suspended or held apart by slings, hoists, or jacks also will be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

Bulldozer and scraper blades, front end-loader buckets, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls will be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

Stationary machinery and equipment will be placed on a firm foundation and secured before being operated.

All points requiring lubrication during operation will have fittings so located or guarded to be accessible without hazardous exposure.

When necessary, all mobile equipment and the operating area will be adequately illuminated while work is in progress.

Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shutoff that will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.

All towing devices used on any combinations of equipment will be securely mounted and structurally adequate for the weight drawn.

Persons will not be permitted to get between a piece of towing equipment and the item being towed until the towing equipment has come to a complete stop.

All equipment with windshields will be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields will be equipped with operable defogging or defrosting devices.

All equipment left unattended at night, adjacent to a highway in normal use, or adjacent to construction areas where work is in progress, will have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

Whenever the equipment is parked, the parking brake will be set. Equipment parked on inclines will have the wheels chocked or track mechanism blocked and the parking brake set. Equipment such as lift trucks and stackers will have the rated capacity posted on the vehicle so as to be clearly visible to the operator. When auxiliary removable counterweights are provided by the manufacturer, corresponding alternate rated capacities also will be clearly shown on the vehicle. The ratings will not be exceeded.

Steering or spinner knobs will not be attached to the steering wheel unless the steering mechanism prevents road reactions from causing the steering hand wheel to spin. When permitted, the steering knob will be mounted within the periphery of the wheel.

All industrial trucks in use will meet the requirements of design, construction, stability, inspection, testing, maintenance, and operation, defined in American National Standards Institute (ANSI) B56.1, Safety Standards for Powered Industrial Trucks.

The installation of live booms on material and personnel hoists is prohibited.

The controls of loaders, excavators, or similar equipment with folding booms or lift arms will not be operated from a ground position unless so designed.

Personnel will not work or pass under the buckets or booms of loaders in operation.

Cranes and any other equipment used for lifting must be inspected as required and records of inspection must be maintained.

Drill Rigs

See FLD 56, *Drilling Safety*

FLD 34 UNDERGROUND UTILITIES

REFERENCES

29 CFR 1926.651, *Specific Excavation Requirements*
ANSI Standard Z 535.1, *American National Standard for Safety Color Code*

RELATED FLDs

FLD 42 – Lockout/Tagout

This Field Operation Procedure (FLD) provides requirements for identification, location, and avoidance of underground utilities, appurtenances, and structures during intrusive activities. These requirements are applicable to all Weston Solutions, Inc. (WESTON) operations. The procedures address the requirements and recommendations for identifying and locating, working around, and encountering or contacting underground utilities. The FLD also addresses actions to be taken in response to encountering or contacting underground utilities.

DEFINITIONS

Aggressive Methods

The use of mechanized equipment such as (but not limited to) excavators, backhoes, drill rigs, directional drilling, Geoprobe operations (including all direct push techniques), or road saws.

Buffer Zone

As defined in this procedure, the area around a utility where only non-aggressive excavation methods may be utilized, unless specific conditions are met.

The definition cited above, and the excavation requirements and restrictions associated with it, will vary depending on the particular state regulations. WESTON requires the imposition of a **three-foot** Buffer Zone on all sides of the utility as measured from the outside edges of the utility, both horizontally and vertically. State and/or local buffer zone requirements must be verified by consulting the applicable state regulations in the event buffer zones greater than three feet are required.

THE TERM “BUFFER ZONE” MAY BE REFERRED TO AS THE “TOLERANCE ZONE”, “SAFETY ZONE”, OR “APPROXIMATE Location of Underground Utilities” in some jurisdictions.

Competent Person

A Competent Person has the ability to recognize hazards associated with underground utilities and the authority to stop or direct operations to ensure the safety of personnel and conformance with this procedure. The Competent Person has an understanding of this procedure, and the “One-Call” system requirements for the jurisdiction where excavation is occurring. The Competent Person must be capable of notifying One-Call agencies and maintaining and tracking One-Call Locate Numbers. Additionally, they must have knowledge of methods and work practices for excavation work and the identification, avoidance, and protection of underground utilities.

The designation of a Competent Person will be made by the Site Manager (SM) or Project Manager (PM) and documented in the site-specific Health and Safety Plan (HASP) or attachment to the HASP. Each WESTON Competent Person is required to successfully complete WESTON’s internal training program on the use and application of this FLD and possess appropriate and relevant field experience.

The names of Subcontractor Competent Persons will be documented in the Site-Specific *Subcontractor Acknowledgment: Supervisor Personnel, Competence of Personnel, and Task Understanding* form. Subcontractor Competent Persons will be expected to follow this FLD or their company's procedures, whichever is more restrictive.

Damage

Damage may be considered as any undesired impact or unanticipated removal of support from an underground utility as a result of excavation or demolition. Damage may be as simple as minor contact (by any means) resulting in displacement of protective coating. The utility owner must be contacted regarding any damage or question of damage.

De-Energize

As applicable to a utility, to physically eliminate and/or prevent the presence, transmission, flow, or release of energy or materials which may cause harm to personnel or property.

Excavation (Intrusive Activity)

An operation using mechanized equipment for the purpose of movement or removal of earth, rock, or the materials in the ground, including but not limited to: digging, blasting, augering, test boring, drilling, pile driving, directional drilling, grading, plowing-in, hammering (including hammer-drill soil gas sampling tube installation), pulling-in, jacking-in, trenching, tunneling, structural demolition, milling, scraping, tree and root removal (grubbing), and fence or sign post installation. Note that in some States or jurisdictions, excavation may include hand augering or use of other hand tools.

Jurisdiction

The Authority having legal jurisdiction for establishing and/or enforcing regulations and requirements for notification of excavation activities and associated identification and marking of underground utilities. In the United States, the States have jurisdiction, and most consider the regulations applicable when excavation is to be performed in any location, including any public or private way, any company right-of-way or easement, or any public or privately owned land or way. Note: One caveat to remember – Jurisdiction may flow to the “owner” on private or government-owned property because the State One-Call Agencies may not clear utilities on such facilities.

Note that easement boundaries may require differing methods for compliance assurance. Railroads and certain above ground utilities have easements that require specific procedures for excavation (including shoring and shielding of both the utility as well as for the track and/or poles). In these cases it may be required that an inspector or representative of the railroad or utility is present at all phases of the activity.

Locate

To indicate the existence of a utility by establishing a mark through the use of flags, pins, stakes, paint, or some other customary manner, that *approximately* determines the location of a line or facility.

Locate Request

A communication between an entity performing intrusive activities and a utility marking agency (One-Call, etc).

Non-Aggressive Methods

Non-Aggressive methods involve the use of manual methods such as hand digging with shovels or by potholing or daylighting methods.

Observer

The person assigned to visually monitor and, as needed, signal the operator during mechanized intrusive activity when the activity is occurring within three feet of the outside edge of the buffer zone. The observer remains in close communication with the equipment operator(s) and will stop the activity if needed.

One-Call Agency

An entity that administers a system through which a person can notify owners/operators of underground lines or utilities of the intent to perform intrusive activities in proposed public areas. **It is important to note that not all underground utility owners may be required to join the One-Call system. Additionally, some underground utility owners may not comply with State registration requirements.** The SM or Competent Person is responsible to determine additional utilities that may need to be contacted individually.

Positive Response

Verification prior to the intrusive activity, to ensure that all contacted (typically via the One-Call Agency) owner/operators have located and marked the underground utilities. The SM or Competent Person is responsible to determine/verify ownership of the property where the intrusive activity will occur, including any easements.

Potholing or Daylighting

The practice of exposing an underground facility by safe, *non-aggressive* excavation methods in order to determine the precise horizontal and vertical position and orientation of underground lines or utilities. Potholing or daylighting are terms used to describe the excavating of buried facilities using an air or water “knife” coupled with vacuum excavation that exposes underground utilities to the “daylight” – a positive and safe means of identification and confirmation of exact utility location.

Target Rich Environment

Areas where multiple utilities are known or suspected of being located, areas where utility locations are in question and/or difficult to obtain information on, or areas with known or suspected high-risk utilities. **Note: Military Bases (active or inactive) are to be considered “Target Rich Environments”.**

Underground Utility

An underground or submerged conductor, pipe, or structure used in transporting or providing electric, communications service, gas, oil or oil product, sewage, storm drainage, water, or other service and appurtenances thereto. As used in this procedure, utility includes all underground appurtenances and structures.

The following are examples of the types of underground utilities that may be present in a given location:

- Natural gas pipelines
- Electric cables

- Water pipelines
- Fiber optic telecommunications lines
- Telephone cable lines
- Steam pipelines
- Gasoline, oil, or other fuels
- Sewer pipelines
- Vents for sewer and gasoline/diesel fueling systems
- Underground Storage Tanks (USTs)
- Abandoned underground structures containing hazardous materials, hazardous wastes, and radioactive materials

Underground Utility Owner

Any person, utility, municipality, authority, political subdivision or other person or entity who owns, operates, or controls the operation of an underground line/facility.

White Lining

The practice whereby the person (in this case WESTON or a Subcontractor) who intends to perform intrusive activities, pre-marks the site with an outline of the area where intrusive activities will occur. This involves the use of white paint, flags, stakes, or a combination thereof to mark the extent of where work is to be performed. The marking may vary depending on what intrusive activities are to be conducted. For example, for general excavation, an areal outline of the excavation shall be marked, while for drilling, the individual boreholes shall be marked. Studies have shown that pre-marking is a practice that does prevent utility contact incidents. Check State or local regulatory requirements to ensure compliance.

RESPONSIBILITIES

Competent Person

The Competent Person shall be responsible for:

- Obtaining a copy of, and understanding the applicable regulations for the state of jurisdiction where the excavation activities are to be performed.
- Contacting the appropriate One-Call Agency or private locating service, as applicable.
- Recording One-Call locate numbers.
- If necessary, renewing One-Call locate numbers before expiration.
- Ensuring that white-lining of the area to be excavated is performed; if another equal or better protective measure is necessary because of the nature of the work, state/local regulation, or client requirements, the HASP should be amended to reflect the change.
- Ensuring that a “positive response” has been received from every utility owner/operator identified by the One-Call Agency (and any non-member utility as necessary) and that they have located their underground utilities and have appropriately marked any potential conflicts with the areas of planned intrusive activities prior to the start of intrusive work.

- Ensuring that appropriate means for supporting and protecting any exposed utility have been discussed with the utility owner and such means are available on-site.
- Ensuring that above-ground utilities and other appurtenances will not create a problem, or be impacted by WESTON activities. In all cases provisions for protection of any utility, structure, or appurtenance must be made.
- Ensuring that provisions for emergency actions and emergency shut-off/mitigation of utilities have been discussed with utility owners and field personnel.
- Ensuring that pictures are taken before, during, and after intrusive activities and placing such pictures in the project file. Pictures should provide visual documentation of actual site conditions, including but not limited to exposed utilities, methods used for bracing utilities and markings placed on the surface by utility locating services. Consideration should also include placing of a known object in the picture field to provide a “scale” for size/distance comparison.
- Completion and maintenance of the Underground Utilities Locating and Marking Checklist (Attachment A) and the Underground Utilities Management Checklist (Attachment B).
- Reviewing applicable Activity Hazard Analyses (AHAs) with all project members before work begins.
- Conducting training on communication protocols to be used by the excavation observer and equipment operator.
- Ensuring implementation of appropriate work practices during intrusive activities (including maintaining the prescribed buffer zone for use of aggressive methods).
- Conducting daily or more frequent (due to changes in conditions) inspections of the excavation area to make sure that all markings are intact.
- Providing the Field Safety Officer (FSO) with all required documentation on a daily basis.

Observer

Whenever intrusive operations with mechanized equipment are being conducted *within three feet of the outside edge of the buffer zone*, horizontally and vertically, an observer must be assigned to monitor the activities. The observer is responsible for:

- Maintaining a safe vantage point relative to digging machinery, excavation edge, and proximity to the hazard posed by the utility.
- Observing the operation to ensure that the operator stops operations if utilities are observed.
- Reviewing hand signals and other forms of communication with the operator. Note: hand signals should be as those identified under ANSI, OSHA, or the Corps of Engineers for Crane Hand Signals, or another, equally effective and understood system.
- Properly signaling the operator.
- Stopping the operation immediately if the observer’s attention must be diverted even momentarily.
- Stopping the operation immediately if a hand signal or other directive is not followed. Operations will not resume until the observer and operator mutually agree that the reason(s) for not complying with the directive(s) are/is identified and fully corrected.
- Maintaining required records, such as logbook entries, or other, as requested by line management.

Line Management

The PM or SM shall be responsible for:

- Establishing the site culture with the assistance of the FSO that ensures compliance with this FLD, as well as providing the leadership to “do the right thing” whenever unanticipated circumstances arise.
- Providing the necessary resources, including sufficient schedule for compliance with this FLD.
- Designating a Competent Person or ensuring that a subcontractor Competent Person is designated, prior to the start of work.
- Discussing intrusive activity liability with the Client prior to the start of work. Best practices for identification of underground utilities must be included with the proposal and/or HASP, as well as WESTON’s requirement for Client sign-off (if the Client is the property owner or if the Client selects the drilling/intrusive action location) when identifying specific work locations for intrusive activities. In cases where the client, such as EPA, will or cannot sign off on liability or provide indemnification, discussions with the appropriate client representatives on intrusive activities will be documented in the project file.

Note: In any „target-rich” work environment, best practices must include the requirement for potholing/daylighting or careful hand-digging – whenever possible (at least 5 feet below grade) – since these are recognized processes for visually verifying the exact location of underground utilities while minimizing the potential for utility damage.

- **For excavations using aggressive methods in target-rich environments**, consideration should be given for establishing an agreement with an Emergency Response Contractor and/or the specific utility owner prior to the start of intrusive activities. This agreement should include specific emergency notification procedures for each utility identified to ensure that timely response can be accomplished in the event of a utility strike.
- Determining/verifying ownership of the property where the intrusive activity will occur, including any easements.
- Contacting all utilities not notified directly by the utility notification center, including those known to local personnel and the property owner.
- Obtaining Profit Center Manager approval for any deviations from this FLD, including best practices, or for addressing any set of circumstances not specifically addressed in this FLD that may place WESTON or its employees at risk.

Environmental, Health, and Safety Personnel

The FSO shall be responsible for:

- Providing oversight on the implementation of the requirements contained in this FLD.
- Consulting with the PM, SM, Competent Person, and the appropriate Division Environmental, Health, and Safety Manager (DEHSM) (or Corporate EHS) on underground utility issues.
- Acting as the Competent Person or Observer as necessary and qualified.

Procedure

The following sections provide the requirements and recommendations, which are intended to prevent injury to personnel, damage to infrastructure, and associated indirect effects associated with encountering

or contacting underground utilities during intrusive work. Underground utilities present multiple potential hazards that must be recognized before and during work which occurs near them, therefore, this procedure is divided into sections addressing underground utility identification and location, working around or near underground utilities, and actions to be taken in the event that underground utilities are encountered or contacted. Hazards that may be presented by underground utilities include explosion and fire, electrocution, toxic exposures, pathogens, and drowning.

Identifying and Locating Underground Utilities

The potential for underground utilities or other subsurface feature (e.g., subsurface mines) must be evaluated as early as possible in the planning phase for any project which involves intrusive activities. The following sections describe various methods for identifying and locating utilities on a site. The *Underground Utilities Locating and Marking Checklist* (Attachment A) and the *Underground Utilities Management Checklist* (Attachment B) must be completed before any activities meeting the definition of excavation are conducted. Attachment A is intended to be used as a guide during the process of locating and marking utilities in the area to be excavated. Attachment B is intended to be used as a guide in the overall process of underground utilities management during the course of the project.

Note: Attachments A and B or their equivalents must be used to document compliance with this FLD and will be subject to audit.

Prior to excavation all underground utilities must be located and identified by at least two of the following:

- The Utility Owner
- The Property Owner
- A Private or Public Utility Locating Service
- Review of the most current utility drawing, maps or other available records by an approved WESTON Competent Person
- Use of utility locating technology by a WESTON Competent Person or subcontractor – this includes the use of potholing or daylighting in a “target-rich” work environment or whenever a full clearance (without restrictions) cannot be obtained from a utility locating service.

As an aid in determining the potential for or existence of utilities follow the criteria outlined in Attachment C (Utilities Research Options).

Pre-Planning and the Site HASP

The site-specific HASP developed for the project must:

- Identify the location and types of underground utilities that are believed to be present on the site.
- Reference this procedure (FLD 34), and describe how it will be implemented on the project.
- Contain an AHA in which the hazards associated with underground utilities are identified, as well as the measures used to control them.
- Contain any site or contract-specific requirements (e.g., Corps of Engineers, EM 385-1-1, Section 25) that may be applicable.
- Contain clear and concise procedures to be followed in the event that contact with underground utilities occurs.

- Address underground utilities and potential associated scenarios in the emergency response section of the HASP.

“ONE-Call” Locating and Marking Services

Every state has utility marking service programs that have various names such as “One-Call”, “Dig-Safe”, “Call-Before-You-Dig”, “Dig -Safely”, and many others. These services will identify the types and locations of any utility that may exist in an area to be excavated, as long as the property is in the public domain.

- The appropriate One-Call service for the jurisdiction where the project is located must be contacted prior to beginning excavation work. The One-Call Agency should be given as detailed a description of the property as possible; address, cross street, utility pole numbers, physical description, etc.
- Notification to the One-Call service shall allow sufficient lead-time for the Agency to mark the utilities before excavation begins. The lead times vary, but range from two to ten days, depending on the state of jurisdiction.
- In the event the State or Local One-Call service number is in question call "811" (the Federal Call before You Dig Number) for access to the appropriate locator service.
- A complete listing of One-Call agencies and telephone numbers for all states is available in the “*Call-Before-You-Dig Call Center Directory*”, which can be accessed on the Internet at the WebPage (<http://underspace.com/index.htm>) sponsored by “*Underground Focus*” magazine.
- Once notified, the One-Call Agency will provide the contractor with a unique “locate number” or “reference number”. This reference number must be kept in the project files by the Competent Person or designee. Additionally, the reference numbers have expiration dates, which may vary depending on the particular One-Call Agency. The valid period of the locate number and required renew notification date shall be requested from the One-Call Agency.
- On a project with multiple contractors, each contractor must request a separate locate number. Under no circumstances will any other contractor or entity be allowed to “work under our locate number”. Subcontractors to WESTON may excavate under the locate number secured by WESTON, provided that they are excavating within the area which was previously white-lined by WESTON and subsequently marked. **However, the One-Call Agency must be contacted and notified of this arrangement so that the subcontractor can be recorded as working under the existing locate number.** If a WESTON subcontractor will be excavating in an area not white-lined by WESTON, then the WESTON subcontractor must request a new locate. **Note: State and local requirements must be checked for local application of this procedure.**
- The area where work is to be performed shall be white-lined before the locating service goes to the site.
- It is good practice to arrange a pre-excavation meeting at the project site with the personnel performing the utility location and marking. This meeting will facilitate communications, coordinate the marking with actual excavation, and assure identification of high-priority utilities.
- The One-Call Agency should provide the identities of the utility owners that will be notified of the locate request. This information shall be recorded on the Underground Utilities Locating and Marking Checklist (Appendix A) and maintained in the project files. The contact person and phone number for each utility owner shall also be recorded. **Note that all utility owners are not members of the One-Call system.** This does not eliminate the need to contact a non-member owner if you have knowledge or suspect that excavation will impact their utility.

- The utility owners should provide a “positive response” relative to the locate request, which can consist of two types of action by the utility owner. The facility owner or operator is required to 1) mark its underground utilities with stakes, paint, or flags, or 2) notify the excavator that the utility owner/operator has no underground utilities in the area of the excavation.
- The positive responses shall be recorded on the Underground Utilities Locating and Marking Checklist (Attachment A) and crosschecked with the list of utility owners that the One-Call Agency stated they would notify. If it is discovered that a utility owner has not provided a positive response, then the One-Call Agency must be notified.
- Excavation shall not be conducted until positive responses have been received from all utility owners identified by the One-Call Agency as having underground utilities on the property.
- Before beginning excavation, the excavator must verify that the location marked was correct, and the distinct, color-coded markings of all utility owners are present.
- Examine the site to check for any visible signs of underground utilities that have not been located and marked such as pedestals, risers, meters, warning signs, manholes, pull boxes, valve boxes, patched asphalt or concrete pavement, areas of subsidence, fresh sod or grass, lack of grass or vegetation, and new trench lines.
- The markings placed by the utility owners should be documented by WESTON using a still, digital, or video camera, whenever practical and reasonable. The photo-documentation shall be maintained with the project files.
- The markings placed by the utility owners or marking services typically follow the American Public Works Association Uniform Color Code as described in ANSI Standard Z 535.1. This code follows:

American Public Works Association Uniform Color Code

Red		Electric Power Lines, Cables, Conduit
Orange		Communications, Telephone, Cable TV
Yellow		Gas, Oil, Steam, Petroleum or Gaseous Materials
Green		Sewers and Drains
Blue		Potable Water Systems
Purple		Reclaimed Water, Irrigation, Slurry Lines
Pink		Temporary Survey Markings
White		Proposed Excavation

Note: Unless otherwise specified in the utility clearance, such clearance will not be considered valid after 30 days from the date it was issued.

Private Utility Locating and Marking Services

- **One-Call agencies arrange for the identification and marking of underground utilities only on public property, up to the point of contact with private property.** In the event that activities are to be conducted on non-public properties, the presence, location, depth, and orientation of all underground utilities shall be ascertained through records review, including any site plot plans, utility layout plans, and as-built drawings available from the property owner, as well as through interviews with knowledgeable personnel associated with the property (See Attachment C). Additionally, for excavations using aggressive methods in target-rich

environments or other situations where utility locations are in question, the information gathered from these sources shall be verified by physical detection methods (non-aggressive), performance of a geophysical survey, or by procuring the services of a private utility locating and marking service. If any detection methods are to be self-performed, the requirements within this FLD must be followed. **A list of vendors providing this service can be found in the “Network of Underground Damage Prevention Professionals” which can be accessed on the Internet at the “Underspace” WebPage (<http://underspace.com/index.htm>).**

Self-Performance of Utility Locating and Marking

The techniques and instruments used to locate and characterize underground utilities can be extremely complicated and difficult to use effectively. Additionally, interpretation of the data generated by this instrumentation can be difficult. The utility marking services, as previously described are staffed by well-trained, experienced professionals who perform locating activities on a regular basis. For these reasons, it is most desirable that these professional services are used for utility location and marking on projects.

- In some instances on private property or in other areas not served by One-Call agencies (e.g., long-term projects where excavation is a primary task, and the presence of underground utilities is extensive) it may be prudent to self-perform locating and marking activities.
- If locating and marking is to be self-performed, all personnel using instrumentation will be trained on the use of the equipment that will be used, and the interpretation of the data.
- There are a variety of locating methods which may be utilized for self-performance of utility locating as categorized below:
 - Magnetic field-based locators or path tracers
 - Buried electronic marker systems (EMS)
 - Ground penetration radar-based buried-structure detectors
 - Acoustics-based plastic pipe locators
 - Active probes, beacons, or sondes for non-metallic pipes
 - Magnetic polyethylene pipe
- Before self-performing any underground utility locating on a project, approval must be obtained from the appropriate WESTON DEHSM or the Corporate EHS Director.

Working Near or Around Underground Utilities

After the site has been properly evaluated for the presence of aboveground utilities, underground utilities, and other appurtenances, intrusive activities may begin. Because there is no perfect way of eliminating the hazards presented by underground utilities, an effort must be made to perform the tasks following the direction and guidance as described by the following best practices that should be implemented during the execution of the project.

Work Site Review

Before beginning intrusive activities, a meeting shall be held between all members of the project team. This shall consist of a review of the marked utility locations with the equipment operators, observers, laborers, etc.

Preservation of Marks

During excavation, efforts must be made to preserve the markings placed by the utility owners until they are no longer required. If any markings are obliterated, the One-Call Agency must be contacted for re-marking. No intrusive activities are to take place if markings are not visible.

Excavation Observer

Whenever intrusive operations are being conducted within three feet of the edge of the buffer zone, an observer must be assigned to monitor the activities. The observer will be designated each day, and a review of hand signals and other forms of communication between the observer and operator will be conducted. The directives of the observer will be followed precisely and immediately by those operating equipment.

Excavation Within The Buffer Zone

Mechanical means of excavation may not be used within 36 inches (see Buffer Zone) of any marked or suspect utility until the utility has been exposed. Mechanical methods may be used, as necessary, for initial penetration and removal of pavement, rock or other materials requiring use of mechanical means of excavation provided a spotter is used. Once the underground utility has been exposed, further excavation must be performed, employing reasonable precautions to avoid damage to the utility, including but not limited to any substantial weakening of structural or lateral support, or penetration or destruction of the utility or its protective coatings. For purposes of this section, “mechanical means of excavation” means excavation using any device or tool powered by an engine except air vacuum or like methods of excavation.

A request to utilize aggressive excavation methods in the buffer zone may be made if:

- There is no other appropriate and reasonable alternative to using aggressive methods in the buffer zone; and
- The utility has been de-energized (and purged if necessary), verified as de-energized, and locked-out; or
- The depth and orientation of the utility has been adequately and visually determined through the use of non-aggressive methods such as air/hydro/vacuum excavation, potholing, probing, hand-digging, or a combination thereof; and
- For utilities containing electrical energy, the depth of the existing water table is below the location of the utility; and
- Request for the exemption has been submitted to the appropriate DEHSM and Profit Center Manager for approval.

The following conditions will apply to this request:

- Aggressive methods may be used in the buffer zone only to the extent allowed by the applicable state or other jurisdictional regulations.
- Appropriate physical protection measures for exposed utilities shall be implemented to eliminate the potential for equipment contact with utilities.
- The extent of the project excavation area to be covered by the exemption request must be specified in the request for exemption.
- When evaluating the use of aggressive excavation methods in the buffer zone, the DEHSM will consider the type of utility involved and the associated risk potential. Based on this evaluation, the Profit Center Manager and/or DEHSM may impose further conditions and requirements. Even if the above exemption conditions are met, the DEHSM has authority to deny the request.

Unless exempted according to the above provisions of this procedure, only non-aggressive methods may be used within the buffer zone. These methods are used in order to prevent mechanical contact with underground utilities, which could result in damage to the utility and create the potential for personal injury and property damage. Following are examples of non-aggressive excavation methods:

- Hand-digging
 - Non-conductive hand tools must be used when digging within the buffer zone surrounding underground electrical utilities.
 - If conductive hand tools must be used near electrical lines, then the FSO and/or DEHSM shall be consulted to determine additional requirements relative to safe electrical practices, procedures, and equipment.
- Hydro-excavation (water pressure).
- Air excavation (air pressure).
- Vacuum extraction (soil excavation/removal).
- Air excavation/vacuum extraction combination.
- Aggressive methods may be used for the removal of pavement over a utility, if allowed by the state regulations.

Protection of Underground Utilities

It is very important that consideration be given to the protection of underground utilities when performing adjacent intrusive activities. This is necessary not only to prevent physical damage and associated indirect effects, but also to prevent the potential for injury to employees and the public.

- When using aggressive excavation methods within the buffer zone around exposed underground utilities, physical protection must be used as required by OSHA in 29 CFR 192 6.651. Basically, this involves creation of a physical barrier between the mechanized operation and the utility. The following are some possible types of physical protective measures:
 - Heavy timbers, similar to swamp or crane mats.
 - Sheets of plywood.
 - Blasting mats.
- Once exposed, underground utilities no longer have the support provided by surrounding soil and may need to be physically supported to prevent shifting, bending, separation, or collapse, which could result in damage to the utility, and possibly personnel. Following are suggested support methods:
 - Timber shoring underneath the utility.
 - Timbers or girders over the top of the excavation fitted with hangers that support the utility.
 - Design by a Professional Engineer for complicated or large applications.
- Utilities must also be protected from objects that may fall into the excavation such as rocks and equipment. This can be accomplished by following these guidelines:
 - Cast spoils as far away from the excavation as possible. Excavated and loose materials shall be kept a minimum of two feet from the edge of excavations.
 - Relocate large rocks, cobbles, and boulders away from the excavation and sloped spoils piles.

- When vehicles and machinery are operating adjacent to excavations, warning systems such as soil berms, stop logs or barricades shall be utilized to prevent vehicles from entering the excavation or trench.
- Scaling or barricades shall be used to prevent rock and soils from falling into the excavation.
- Barriers shall be provided to prevent personnel from inadvertently falling into an excavation.

De-Energizing Utilities

Utilities can carry many types of potential energy, including electricity, flowing liquids, liquids under pressure, or gasses under pressure. A release may happen if a utility conveyance is compromised and could result in personal injury, property damage, and other indirect effects. If the white lines of the proposed excavation area overlaps or extends into the buffer zone of a known underground utility, then if at all possible, that utility should be de-energized to physically prevent the transmission, flow, or release of energy. Conversely, if the buffer zone of the known utility lies outside of the white-lined, proposed excavation area, then de-energizing is not required.

- The owner of the utility shall be contacted to determine the feasibility and methodology of de-energizing the utility. Plenty of lead-time should be provided for this since it may take utility companies weeks to de-energize some utilities.
- Depending on the utility and the material being conveyed, isolation points which may be suitable for de-energizing include but are not limited to the following:
 - Electrical circuit breakers
 - Slide gate
 - Disconnect switches
 - Piping flanges
 - Other similar devices
- When utilities are de-energized, it must be verified by demonstration. This can be accomplished by methods such as, testing equipment, switching on a machine or lighting, or opening a valve. For any current-carrying electrical equipment, such as cables or electrical panels, successful de-energizing must be certified through the use of appropriate electrical testing equipment and qualified personnel.
- Whenever a utility is de-energized, a means of ensuring that the energy isolation device and equipment cannot be operated until the device is removed must be provided.
- When de-energizing and locking out of utilities is practiced, the provisions of FLD 42 Lockout/Tagout shall be followed, as applicable.

Damage Discovery

During excavation, utility damage may be discovered which is pre-existing or otherwise not related to a known contact. Disclosure to the utility owner is very important because the possibility of utility failure or endangerment of the surrounding population increases when damage has occurred. The utility may not immediately fail as a result of damage, but the utility owner or operator must be afforded the opportunity to inspect the utility and make a damage assessment and effect repairs if necessary. The following guidance applies:

- Observe and photograph the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, or other damages to utility lines, conduits, coatings, or cathodic protection systems.

- The owner of the affected utility must be contacted immediately.
- The One-Call Agency or private location service must be contacted immediately.
- A Notification of Incident (NOI) Report will be used to document such a discovery.

Encountering Unexpected Underground Utilities

It is possible that underground utilities will be encountered in locations that have previously been “cleared” of having underground utilities by the locating service, or are found outside of the area, which has been marked as having underground utilities. In either case, if this occurs, the following applies:

- Site personnel must be warned and moved to a safe location; equipment engines and ignition sources should be turned off, if possible, as the operator is exiting his/her equipment.
- Intrusive activities must be stopped.
- The owner of the affected utility must be immediately contacted.
- The One-Call Agency or private location service must be contacted immediately.
- The PM, SM, and FSO must be notified.
- No further intrusive activities may be conducted until:
 - The One-Call Agency/private location service and/or the subject utility owner visit the site;
 - Identification of the utility owner and the type of material/energy being conveyed by the utility has been made; and
 - The orientation and depth of the subject utility has been determined and suitably marked.
- A NOI Report must be completed. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.

Contacting Underground Utilities

If excavation or other equipment being used for intrusive activities makes contact with an underground utility, the following guidelines apply:

- Site personnel must be warned and moved to a safe location; equipment engines and ignition sources should be turned off, if possible, as the operator is exiting his/her equipment.
- Intrusive activities must be stopped immediately.
- Observe the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, scratched coatings, cathodic protection compromise, material leakage, obvious electrical energy.
- Move all personnel to the evacuation meeting point as described in the HASP.

EXCEPTION: *If an electrical line has been contacted and it is your belief that equipment (such as an excavator) is electrically energized, do not approach the equipment. Order the operator to remain in the equipment until emergency personnel can de-energize the source (unless the equipment is on fire, at which time the operator should jump off of the vehicle and shuffle along the ground to a safe area). Shuffling is required because current flows outward through the soil in a ripple pattern called a power gradient, creating a pattern of high and low potential, Shuffling decreases the chance that these gradients could be bridged, causing current to flow through the body, resulting in electrocution.*

- Secure the area to prevent the public from entering.
- Contact emergency responders as specified in the HASP.
- Immediately contact the One-Call Agency or if known, the utility owner.
- Notify the PM, SM, FSO and DEHSM.
- No further intrusive activities may be conducted until:
 - The utility owner inspects the scene and after repairs, verifies that all danger has passed
 - The orientation and depth of the subject utility has been determined and suitably marked.
 - Permission from the emergency responders to resume work has been given.
- A WESTON NOI Report must be completed. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.
- State and Local regulations must be reviewed to determine if reporting to any additional agencies is required.

ATTACHMENTS

Attachment A – Underground Utilities Locating and Marking Checklist

Attachment B – Underground Utilities Management Checklist

Attachment C – Utilities Research Options

Attachment D – Sources of Information

Informational Addendum 16 June 2010

ATTACHMENT A
UNDERGROUND UTILITIES LOCATING AND MARKING CHECKLIST

Weston Solutions, Inc.

To be Completed by PM and/or "Competent Person"
 Complete Form as Location/Marking Progresses and Maintain in Site Files

PROJECT INFORMATION:	Location:
Project Name:	Task/Activity:
WESTON Competent Person:	Start Date of Work:
WESTON Subcontractor: <input type="checkbox"/> No <input type="checkbox"/> Yes:	Private Locating Service Required: <input type="checkbox"/> Yes <input type="checkbox"/> No
Subcontractor Competent Person:	If Not, Explain:
Property Owner:	
NOTIFICATION:	
Locating Service Name:	Locating Service Tel. Number:
Date Locating Service Notified:	Locate Ticket Number:
Address of Property to be Marked:	Locate Ticket Expiration Date:
Nearest Intersecting Street:	
Are There Any Utilities on the Properties That the Locating Service Will Not Contact? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Specify:	

Enter Utility Information in Table 1 Below. In Addition to Utility Locating Services, Consult Client, Utility Owners, Drawings, Facility Personnel, Maintenance Personnel, Municipalities (See Appendix C).

Table 1. On-Site Utility Information

Name of Utility Company	Type of Utility	Color Code	Utility Present On-Site?	Emergency Phone Number	Date Marks Completed
	Electric	RED			
	Communications, Phone, CATV	ORANGE			
	Gas, Oil, Steam, Petroleum	YELLOW			
	Sewers, Drains	GREEN			
	Potable Water	BLUE			
	Reclaimed Water, Irrigation	PURPLE			
	Temporary Survey Markings	PINK			
To be performed by excavator prior to utility mark-out.	Proposed Excavation	WHITE			

White-Lining Completed?

☐ No Explain: _____ ☐ Yes: Date: _____ By Whom? _____

LOCATING AND MARKING:

Have All Utilities Identified in Table 1 Been Marked?

☐ Yes ☐ No (If No, Contact Locating Service for Resolution)

Problem(s) With Markings?

☐ Yes ☐ No ☐ No Marks ☐ Incorrect Location ☐ Too Wide

☐ Other: _____ ☐ Not All Utilities Marked Per Table 1 (notify marking service)

Measurements Taken: ☐ Yes ☐ No

Documentation of Marks: ☐ Photos ☐ Video ☐ Other: _____

EXCAVATION:

Utilities Accurately Marked? ☐ Yes ☐ No

If no, describe: _____

Were Unmarked or Mis-Marked Utilities Encountered? ☐ Yes ☐ No

If Yes, Specify: _____

Locating Service Notified? ☐ Yes ☐ No

Will Excavation Continue Past Locate Number Expiration? ☐ Yes ☐ No

If Yes, Locate Number Renewed? ☐ Yes ☐ No New Expiration Date: _____

Any Other Problems/Concerns? Specify: _____

Form Completed By:	Signature:	Date:
--------------------	------------	-------

ATTACHMENT B
UNDERGROUND UTILITIES MANAGEMENT CHECKLIST

Weston Solutions, Inc.

TO BE COMPLETED BY PM AND/OR "COMPETENT PERSON"

Complete Form as Project Progresses and Maintain in Site Files.

PHASE	TASK	YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
Pre-Planning	1 Excavation/Best Practices in Work Scope?				
	2 Underground Utilities Identified?				
	3 Competent Person Assigned?				
	4 Has a Copy of the Applicable State Regulations Been Obtained, Read, Understood?				
	5 EHS Plan Addresses Underground Utilities? (AHAs, Contingency Plan, State Regulations Appendix)				
Identifying, Locating and Marking	6 Locating and Marking Checklist Initiated? (Attachment A)				
	7 Identification and Address of Property Determined, Including Nearest Intersection?				
	8 One-Call Agency Contacted?				
	9 Additional Locating and Marking Required on Property? (One-Call agency marks to public property line only)				
	10 Additional Marker/Locator Identified?				
	11 Additional Marker/Locator Qualified?				
	12 Weston Self-Performing Location and Marking?				
	13 If Yes to 12 Above, Approval From Division EHS Manager?				
	14 AREA OF EXCAVATION "WHITE-Lined" by WESTON?				
	15 WESTON Present When Markings Completed?				
	16 All Utilities Marked? (Refer to Attachment A, Table 1)				
	17 All Markings Photo/Video Documented?				

PHASE	TASK		YES	NO	NA	COMMENTS
						Required if Response is No or NA. (Reference Item Number)
Identifying, Locating and Marking – Continued	18	Area Checked for Signs of Previous Excavation? (Subsidence, new grass, patching, etc)				
	19	All Applicable Information Recorded on Attachment A?				
	20	Multiple Contractors Excavating On-Site?				
	21	Separate Locate Requests for All Contractors?				
	22	WESTON Subcontractors Excavating in WESTON White- Lined Area(s)?				
	23	If Yes to 22 Above, One-Call Agency Contacted to Determine if WESTON Subcontractor Can be Added to Existing Locate Ticket?				
Excavation Activities	24	Meeting and Site Walkover Conducted with Project Personnel? (Managers, Equipment Operators, Laborers, Competent Person, Excavation Observer, etc)				
	25	AHA and HASP Review Conducted With Personnel?				
	26	Do Site Activities Have Potential to Obliterate Utility Markings?				
	27	If Yes to 26 Above, Have Provisions Been Made to Preserve Markings?				
	28	Has an Excavation Observer Been Designated to Monitor Excavation When Occurring within 3 Feet of the Buffer Zone?				
	29	Have Operator and Observer Reviewed Commands and Signals?				
	30	Has WESTON-Required Buffer Zone Been Marked on Either Side of Markings Placed by Locator?				

PHASE	TASK		YES	NO	NA	COMMENTS
						Required if Response is No or NA. (Reference Item Number)
Excavation Within Buffer Zone	31	Is Excavation Within The Buffer Zone Absolutely Necessary?				
	32	If Yes to 31 Above, Can Non-Aggressive Methods Be Used For Excavation In The Buffer Zone? If Yes, Identify Appropriate Non-Aggressive Methods.				
	33	If No to 32 Above, Has a Buffer Zone Exemption Request Been Approved? If No, then Aggressive Methods May Not Be Used in The Buffer Zone.				
	34	If Yes to 33 Above, Has the Utility Been De-Energized, Purged, Verified/Tested, and Locked-Out? Or, Has The Depth and Orientation of the Utility Been Adequately and Visually Determined Through The Use of Non-Aggressive Methods?				
	35	If Yes to 34 Above, Have All of The Following Conditions Been Met? For Utilities Containing Electrical Energy, Is The Depth of The Water Table Below The Depth of The Utility? Have Regulations Been Consulted to Determine Specific State Requirements Relative to Excavating in The Buffer Zone? Have Appropriate Physical Protection Measures Been Implemented to Prevent Equipment Contact With Utilities and to Prevent Damage to Utilities? If No to Any of The Above Conditions, Then Only Non-Aggressive Excavation Methods May Conducted in The Buffer Zone, Since The Conditions of The Exemption Have Not Been Satisfied.				
Working Around Exposed Utilities	36	If Necessary, Have Provisions Been Made to Support the Utility During Work Activities?				
	37	Have Spoils Been Placed as far Away From the Excavation as Feasible?				

PHASE	TASK		YES	NO	NA	COMMENTS
						Required if Response is No or NA. (Reference Item Number)
Working Around Exposed Utilities – Continued	38	Has the Utility Been De-Energized? (If Any Portion of the Buffer Zone around a Utility is Inside of the White-Lined Area)				
	39	Has the Isolation Point for the De-Energized Utility Been Physically Locked-Out?				
	40	If No to 39 Above, Has a Spotter Been Assigned to Monitor Isolation Point?				
	41	If Yes to 40 Above, Does the Spotter Have Adequate Communications? (Radio, Telephone, etc)				
	42	Has the Isolation Point Been Tagged?				
Damage Discovery	43	Has Pre-Existing Damage to a Utility Been Discovered During Excavation?				
	44	If Yes to 43 Above, Has the One-Call Agency and/or Utility Owner Been Notified?				
	45	If Yes to 43 Above, Have Photographs Been taken?				
Encountering or Contacting Underground Utilities	46	Have Utilities Been Encountered in Locations That Have Not Been Marked?				
	47	If Yes to 46 Above, Has the One-Call Agency or Other Locating Service Been Contacted?				
	48	If Yes to 46 Above, Has the PM and Appropriate DSM Been Notified?				
	49	If Yes to 46 Above, Has a WESTON Notification of Incident (NOI) Report Been Completed? (Include Photographs)				
	50	Have Excavation Equipment Come In Contact With Underground utilities?				
	51	If Yes to 50 Above, Were Intrusive Activities Immediately Curtailed?				

PHASE	TASK		YES	NO	NA	COMMENTS
						Required if Response is No or NA. (Reference Item Number)
Encountering or Contacting Underground Utilities – Continued	52	If Yes to 50 Above, Has a Damage Determination Been Made From a Safe Distance?				
	53	If Yes to 50 Above, Has the Area Been Secured?				
	54	If Yes to 50 Above, Have Emergency Responders Been Notified?				
	55	If Yes to 50 Above, Has the Locating Agency and/or Utility Owner Been Notified?				
	56	If Yes to 50 Above, Have State and Local Reporting Requirements Been Met?				
	57	If Yes to 50 Above, Were Intrusive Activities Curtailed Until Inspection From Utility Owner, Orientation and Depth of Utility Was Determined and Marked, Permission From Emergency Responders Given?				
	58	If Yes to 50 Above, Has a WESTON Notification of Incident (NOI) Report Been Completed? (Include Photographs)				

CHECKLIST COMPLETED BY:

NAME

SIGNATURE

DATE

NAME

SIGNATURE

DATE

ATTACHMENT C
UTILITY RESEARCH OPTIONS

In the course of determining and verifying underground utility location it is expected that a minimum of two resources will be used. As a means of assisting the search for sources, the following is offered.

Records Sources:

- ☐ Utility Section of the State DOT or other Public Agency
- ☐ One-Call Center
- ☐ Public Service Commission or similar organization
- ☐ County Clerks Office
- ☐ Landowner
- ☐ Internet or Computer database
- ☐ Visual Site Inspection
- ☐ Utility Owner

From the Above Collect:

- ☐ Previous construction plans in the area
- ☐ Conduit maps
- ☐ Direct-Buried Cable records
- ☐ Distribution maps
- ☐ Service record maps
- ☐ As-built and record drawings
- ☐ Field notes
- ☐ County, city, utility owner or other geographic information system database
- ☐ Circuit diagrams
- ☐ Oral histories (current or previous employees, residents).

Review Records and Obtain Information For:

- ☐ Indications of additional and/or other available records
- ☐ Duplicate information that lends credibility to data
- ☐ Any additional need for clarifications from owners/others

ATTACHMENT D SOURCES OF INFORMATION

Organizations

- Common Ground Alliance
<http://www.commongroundalliance.com/wc.dll?cga~toppage>
- Center for Subsurface Strategic Action (CSSA)
<http://underspace.com/cs/index.htm>
- DigSafely
<http://www.digsafely.com/digsafely/default.asp>
- National Utility Contractors Association (NUCA)
<http://www.nuca.com/>
- National Utility Locating Contractors Association (NULCA)
<http://underspace.com/nu/index.htm>
- Underground Focus Magazine
<http://underspace.com/uf/index.htm>
- NUCA State Listing of One-Call centers
<http://www.nuca.com/>
- Utility Safety Magazine
<http://www.utilitysafety.com/>

Vendors and Commercial Sites

- RadioDetection, Inc. (Detection Instruments)
<http://www.radiodee.com/>
- Heath Consultants (Detection Instruments)
<http://www.heathus.com/>
- Ben Meadows Company (Detection Instruments)
<http://www.benmeadows.com/cgi-bin/SoftCart.exe/index.html?E+scstore>
- So-Deep, Inc. (Complete Utilities Services)
<http://www.sodeep.com/>
- Concept Engineering Group, Inc. (Air Excavation Equipment)
<http://www.air-spade.com/index.html>
- Rycom Instruments, Inc. (Detection Instruments)
<http://www.rycominstruments.com/>

- Schonstedt Instrument Company (Detection Instruments)
<http://www.schonstedt.com/>
- Forestry Suppliers, Inc. (Fiberglass Probe – “Fiberglass Tile Probe”, Part #77543,
Approx. \$20.00, Telephone 800-647-5368)
<http://www.forestry-suppliers.com/>

REFERENCES

Common Ground Study of One-Call Systems and Damage Prevention Best Practices, August 1999,
Sponsored by US DOT.

INFORMATIONAL ADDENDUM
16 JUNE 2010

Overview of Underground Utility Detection Methods

Induction Utility Locators

Induction utility locators operate by locating either a background signal or by locating a signal introduced into the utility line using a transmitter. There are three sources of background signals that can be located. A utility line can act like a radio antenna, transmitting electromagnetic signals that can be picked up with a receiver. AC power lines have a 50HZ signal associated with them. This signal occurs in all active AC power lines regardless of voltage. Utilities in close proximity to AC power lines or used as grounds may also have a 50HZ signal that can be located with a receiver. A signal can be indirectly induced onto a utility line by placing the transmitter above the line. Through a process of trial and error, the exact above position can be determined. A direct induced signal can be generated using an induction clamp. The inductor clamp induces a signal on specific utilities. This is the preferred method of tracing, where possible. By virtue of the closed loop, there is little chance of interference with the resulting signals. When access can be gained to a conduit, a flexible insulated trace wire can be used. The resulting signal loop can be traced. This is very useful for non-metallic conduits. Finally, these signals can be located horizontally on the surface using a receiver. The receiver is moved across the estimated location of the utility line until the highest signal strength is achieved. This is the approximate horizontal location of the utility. The receiver is then rotated until minimal signal strength is achieved. This will give the approximate orientation of the utility. Vertical depth, however, derived from this equipment is subject to gross error.

Magnetic Locators

Ferrous Metal or Magnetic locators operate by indicating the relative amounts of buried ferrous metals. They have limited application to locating and identifying utility lines but can be very useful for locating underground storage tanks (UST's) and buried manhole covers or other subsurface objects with a large ferrous metal content.

Electromagnetic Surveys

Electromagnetic survey equipment is used to locate metallic utilities. This method pulses the ground and records the signal retransmitted back to the unit from subsurface metal. Particularly useful for locating metal pipelines and conduit, this device also can help locate other subsurface objects such as UST's, buried foundations (that contain structural steel), and pilings and pile caps (that also contain steel).

Ground Penetrating Radar

Ground Penetrating Radar (GPR) is an electromagnetic method that detects interfaces between subsurface materials with differing dielectric constants (a term that describes an electrical parameter of a material). The GPR system consists of an antenna, which houses the transmitter and receiver; and a profiling recorder, which processes the received signal and produces a graphic display of the data. The transmitter radiates repetitive short-duration EM signals into the earth from an antenna moving across the ground surface. Electromagnetic waves are reflected back to the receiver by interfaces between materials with differing dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant at the interface, the conductivity of the material, which the wave is traveling through, and the frequency of the signal. Subsurface features which may cause such reflections are: 1) natural geologic conditions such as changes in sediment composition, bedding and cementation horizons, voids, and water content; or 2) man-introduced materials or changes to the subsurface such as soil backfill, buried debris, tanks, pipelines, and utilities. The profiling recorder receives the signal from the antennae and produces a continuous cross section of the subsurface interface reflections, referred to as reflectors.

Depth of investigation of the GPR signal is highly site specific, and is limited by signal attenuation (absorption) of the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivity such as clays and brackish groundwater, and lowest in relatively low conductivity materials such as unsaturated sand or rock. Maximum depth of investigation is also dependent on antenna frequency and generally increases with decreasing frequency; however, the ability to identify smaller features is diminished as frequency decreases.

The various GPR antennas used are internally shielded from aboveground interference sources. Accordingly, the GPR signal is minimally affected by nearby aboveground conductive objects such as metal fences, overhead power lines, and vehicles.

A GPR survey is performed by towing an antenna across the ground along predetermined transect lines. The antennae is either pulled by a person or towed behind a vehicle. Preliminary GPR transects are performed over random areas of the site to calibrate the GPR equipment and characterize overall site conditions. The optimum time range settings are selected to provide the best combination of depth of investigation and data resolution for the subsurface conditions at the site. Ideally, the survey is performed along a pre-selected system of perpendicular or parallel transect lines. The configuration of the transect lines is designed based on the geometry and size of the target and the dimensions of the site. The beginning and ending points of the transect lines and grid intersection points, or nodes, are marked on the ground with spray paint or survey flags. A grid system is used to increase the probability of crossing the short axis of a target providing a more definitive signature in the data. The location of the antenna along a transect line is electronically marked on the cross section at each grid intersection point to allow correlation of the data to actual ground locations. The location of the targets can be marked on the ground surface using spray paint or survey flags.

Acoustic Location Methods

Acoustic location methods generally apply to waterlines. A highly sensitive Acoustic Receiver listens for background sounds of water flowing; (at joints, leaks, etc.) or to sounds introduced into the water main using a transducer. This method may have good identification results, but can be inaccurate. Acoustics can also be utilized to determine the location of plastic gas lines.

FLD 38 HAND AND POWER HAND TOOLS

REFERENCES

29 CFR 1926 Subpart I

29 CFR 1910 Subpart P

ANSI Standard A10.3-1970, Safety Requirements for Explosive-Actuated Fastening Tools

RELATED FLDs

FLD 06 – Cold Stress

FLD 10 – Manual Lifting and Handling of Heavy Objects

FLD 16 – Pressure Systems: Compressed Gas Systems

FLD 35 – Electrical Safety

INTRODUCTION

Injuries from hand tools are often caused by improper use, using the wrong tool for the job, or from using a defective tool. Workers often assume that they know how to use a common hand tool. Working with something other than the simplest non-powered hand tools shall be performed only by those persons competent or qualified through formal training or documented experience.

Like all tools, hand and power tools must be maintained properly for effective use and safety. This Field Operating Procedure describes general safety guidelines for the four major categories of hand tools: cutting tools, torsion tools, impact tools, and power tools.

The use of any machinery, tool, material, or equipment which is not in compliance with any applicable OSHA 1910/1926 requirement is prohibited. Any tools or equipment identified as unsafe or defective will be “tagged or locked-out.” Controls shall be applied rendering the unsafe or defective tool or equipment inoperable. Any damaged or defective equipment shall be removed from its place of operation. Weston shall be responsible for the safe condition of tools and equipment used by employees, including tools and equipment that may be furnished by employees.

Tags shall be used as a means to prevent accidental injury or illness to employees who are exposed to hazardous or potentially hazardous conditions, equipment or operations, which are out of the ordinary, unexpected, or not readily apparent. Tags shall be used until the identified hazard is eliminated or the hazardous operation is completed. Tags need not be used where signs, guarding, or other positive means of protection are being used.

GENERAL SAFETY RULES – APPLICABLE TO USE OF ALL TOOLS

- Y Tools will be inspected prior to each use. Tools found to be unsafe will be tagged by the inspector “Do Not Use” and either repaired or removed from the site.
- Y Keep the work area clear of clutter.
- Y Keep the work area properly illuminated.
- Y Maintain and keep tools sharpened, oiled, and stored in a safe, dry place.
- Y Wear ear and eye protection when cutting, sawing, drilling, or grinding.
- Y Supervisor should instruct everyone using equipment on safe procedures before they use them.
- Y Inspect tools, cords, and accessories regularly and document any repairs.

- Y Repair or replace problem equipment immediately.
- Y Electric power tools must have a 3-wire cord plugged into a grounded receptacle, be double-insulated or powered by a low-voltage isolation transformer, and fitted with guards and safety switches.
- Y Machine guards must be in-place and not removed during equipment operation.
- Y Do not alter factory-supplied safety features on tools.
- Y Install and repair equipment only if you are qualified.
- Y Use the right tool for the job; for instance, do not use a screwdriver as a chisel or a wrench as a hammer.
- Y Carry a sharp tool pointed downward or place in a tool belt or toolbox.
- Y Protect a sharp blade with a shield.
- Y Store tools in drawers or chests with cutting edge down.
- Y When using power tools, wear long hair in a protective manner, do not wear jewelry or loose clothing, use safety glasses, respiratory protection, hard hats, etc., as needed/specified by the manufacturer. Note that protective gloves should not be worn when operating powered woodworking tools because of the possibility of the work piece snagging the glove and pulling the hand to the cutting surface.
- Y All hand-held power-driven tools must be equipped with one of the following: a constant pressure switch that shuts off the power upon release (e.g., circular saws, hand-held power drills, chain saws) or an on-off switch (e.g., routers, planers scrolls saws, jigsaws).
- Y Never leave a running tool unattended.
- Y All workers using hand and power tools must be properly trained, and training must be documented.
- Y Tools of a non-sparking material must be used if fire/explosion hazards exist.
- Y All fuel-operated tools shall be stopped and allowed to cool prior to being refueled, serviced, or maintained, and proper ventilation provided when used in enclosed spaces.
- Y Bench grinders shall be properly grounded. Work rests must be kept at a distance not to exceed 1/8 inch from the grinding wheel surface.
- Y All persons using grinders or abrasive wheels shall use approved eye-protective devices.
- Y Hand held grinders shall have grinding wheel guards in place during operation.
- Y Train personnel to recognize that tasks involving lifting, repetitive motion, excess pressure, vibration, awkward positions, and remaining stationary for prolonged periods and work in cold conditions increase the risk of musculoskeletal injury. Procedures for avoiding or minimizing risk include: using mechanical devices for lifting, following procedures in FLD 10 when manual lifting is necessary, using shock absorbing gloves when using vibrating tools, choosing tools that reduce gripping force and align joints in a neutral position or holding tools in an ergonomically neutral position, taking breaks or alternating repetitive jobs, and following procedures in FLD 06.
- Y Hand tools such as chisels and punches, which develop mushroomed heads during use must be taken out of service and reconditioned by qualified persons or replaced, as necessary.
- Y Broken or fractured handles on hammers, axes and similar equipment must be replaced promptly.
- Y Worn or bent wrenches must be replaced.

- Y Handles designed for use on files and similar tools must be used.
- Y Jacks must be checked periodically to ensure they are in good operating condition

TORSION TOOLS

Torsion tools are used to grip, fasten, and turn. These include wrenches, pliers, screwdrivers, vises, and clamps. There is a variety of each type of these tools. Selection is very important. Here are a few safety precautions for common torsion tools:

- Y Wrenches should always be pulled and not pushed. Pushing a wrench can cause a loss of control if there is a sudden release of pressure. A short, steady pull should be used rather than quick, jerky motions. Where available, use a socket wrench instead of an adjustable or open-ended wrench. Socket wrenches are generally easier to control, are more convenient, and are less likely to damage a bolt or nut. When using an adjustable wrench, the pressure should be applied to the fixed jaw
- Y Pipe wrenches can easily slip on pipes or fittings, causing injury. To prevent slipping, make sure that the pipe or fitting is clean and the wrench jaws are sharp and kept clean of oil and debris.
- Y Pliers should never be substituted for a wrench. They do not have the same gripping power and can easily slip on a tight object. When using cutting pliers, the object being cut can fly off and cause injury. Wear safety glasses when cutting with pliers.
- Y Screwdrivers are often misused. They should not be used for prying, or as punches or wedges. These misuses can damage the head of the screwdriver. A dull tip can cause the screwdriver to slip. The tip must be flat at the tip and tapered for a snug fit on the screw.
- Y When using vises, make sure that the vise is bolted solidly to a base (e.g., work bench). When cutting material in a vise, try to cut as close to the vise as possible to minimize vibration.
- Y Oil vises regularly.

Screwdrivers

- Y Most screwdrivers are not designed to be used on electrical equipment. Use an insulated screwdriver.
- Y Do not hold an object in the palm of one hand and press a screwdriver into it; place the object on a bench or a table.
- Y Never hammer with a screwdriver.
- Y Check for broken handles, bent blade, etc.
- Y Select a screwdriver of the proper size to fit the screw.
- Y Screwdrivers with a split or splintered handle shall not be used.
- Y The point shall be kept in proper shape with a file or grinding wheel.
- Y Screwdrivers shall not be used as a substitute punch, chisel, nail-puller, etc.

Pliers

- Y Do not use pliers as a substitute for hammers or wrenches.
- Y Use insulated pliers when doing electrical work.

- Y Inspect pliers frequently to make certain that they are free of breaks or cracks.
- Y Pliers shall be kept free from grease and oil and- the teeth or cutting edges shall be kept clean and sharp.
- Y The fulcrum pin, rivet or bolt shall be snug but not tight.

Wrenches

- Y Select the correct size of wrench for the job.
- Y Never use a piece of pipe or another wrench as a wrench handle extension.
- Y Too much leverage can ruin a tool and cause injury.
- Y To avoid sudden slips, stand in a balanced position and always pull on the wrench instead of pushing against the fixed jaw.
- Y Only wrenches in good condition shall be used; a bent wrench, if straightened, has been weakened and shall not be used.
- Y Watch for sprung jaws on adjustable wrenches.
- Y Always pull toward yourself, never push, since it is easier to brace against a sudden lunge toward you should the tool slip or break.
- Y When using a wrench on a tight nut - first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and when possible apply force to the wrench with both hands while both feet are firmly placed. Always assume that you may lose your footing - check the place where you may fall for sharp objects.
- Y Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease that would otherwise build up and cause wrenches to slip.
- Y Never use pipe wrenches in place of a rod holding device.
- Y Replace hook and heel jaws when they become visibly worn.
- Y Position your hands so that your fingers will not be smashed between the wrench handle and the ground or other work surface; when breaking joints the wrench may slip or the joint may suddenly let go.

IMPACT TOOLS

Impact tools include various types of hammers such as riveting hammers, carpenter's claw hammers, and sledgehammers. The main hazard associated with all these tools is damage to the hands and arms. The following safety procedures should be employed when using hammers:

- Y The handle shall be securely fitted and suited for the type of job and type of hammerhead. The striking face of the hammer shall be kept well dressed according to the application.
- Y The handle shall be smooth and free of oil to prevent slippage.
- Y Safety goggles shall be worn at all times when hammering to protect from flying nails, wood chips, and metal or plastic fragments.

- Y To properly drive a nail, hold the hammer near the end of the handle and start off with a light blow. Increase power after the nail is set.
- Y To avoid chipping or spalling of the hammerhead, use the lightest swing possible, hammer straight and not on an angle. Inspect the head of the hammer for potential chipping and spalling.

Hammers

- Y Use the correct hammer for the type of work to be done.
- Y Have an unobstructed swing when using a hammer and watch for overhead interference.
- Y Check for defects before using.
- Y The head of a hammer shall be wedged securely and squarely on the handle and neither the head nor the handle shall be chipped or broken.

CUTTING TOOLS

The main hazard associated with cutting tools is tool slippage. A dull tool or poor tool technique can cause a slip, which can redirect the cutting part of the tool toward the body. In addition, a sudden release or change in the force applied to a tool can throw the user off balance, possibly falling into another object, which may cause injury. To prevent slippage, tools shall be kept sharp and handled in such a way that, if a slip occurs, the direction of force will be away from the body. In addition, cutting along the grain of a material can help prevent changes in the pressure applied to the tool, thereby preventing slippage.

Chisels

- Y Always wear safety goggles or a face shield when using a chisel.
- y Drive wood chisel outward and away from your body.
- y Do not use chisels to pry.
- y Keep edges sharp for most effective work and protect when not in use.

Knives

- Y Always cut away from the body.
- y Keep hands and body clear of the knife stroke.
- y Use a locking blade knife when possible.
- y Keep blades sharp.
 - Knives and other sharp or edged tools must be maintained in proper condition. A sharp edged tool, used properly, is safer than a dull or improperly maintained tool.
 - When not in immediate use edged tools must be properly secured via, sheathing, closing, capping or covering.
 - Any task involving the use of an edged tool must be properly evaluated, alternatives to edged tools reviewed and training in the proper use, maintenance and handling verified by management and/or the site safety officer.
 - Knives, box cutters or like tools will not be authorized for cutting plastic wire ties or tubing. Use appropriately shaped and sized wire cutters or snips.
 - Remove knives from carry on luggage and place in checked baggage.

POWERED TOOLS

- Y Portable power tools shall be carefully inspected before use and shall be kept repaired.
- Y Switches and plugs must operate properly, and the cords must be clean and free from defects.
- Y Portable powered tools capable of receiving guards and/or designed to accommodate guards shall be equipped with guards to prevent the operator from having any part of his body in the danger zone during the operating cycle.
- Y Electric powered portable tools with exposed conducting parts shall be grounded. Portable tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Where such an approved system is employed, the equipment shall be distinctively marked.
- Y Hand-held powered tools of a hazardous nature such as circular saws having a blade diameter greater than two inches, chain saws, percussion tools, drills, tappers, fasteners, drivers, grinders with wheels greater than two inches in diameter, disc sanders, belt sanders, reciprocating saws, saber scroll saws and jig saws with blade shanks greater than one-fourth inch, and other similarly operating powered tools shall be equipped with a constant pressure switch or control ("dead-man switch") that will shut the power off when the pressure is released.
- Y Portable circular saws having a blade diameter over two inches shall be equipped with guards or hoods which will automatically adjust themselves to the work when the saw is in use, so that none of the teeth are exposed to contact above the work. When withdrawn from the work, the guard shall completely cover the saw to at least the depth of the teeth. The saw shall not be used without a shoe or guide.
- Y Pneumatic powered portable tools shall be equipped with automatic air shut-off valves that stop the tool when the operators hand is no longer in contact with the tool. Safety clips, retainers, or other effective means shall be installed on pneumatic tools to prevent the tools from accidentally misfiring.
- Y Abrasive wheels with a diameter of more than two inches shall be used only on machines provided with safety guards. The guards shall cover the spindle end, nut, and flange projections. Guards on operations where the work provides a suitable measure of protection to the operator may be so constructed that the spindle end, nut, and other flanges are exposed.
- Y Explosive-actuated fastening tools' muzzle ends shall have a protective shield or guard designed to confine any flying fragments or particles. The tool shall be so designed that it cannot be fired unless it is equipped with a protective shield or guard. Weston Solutions, Inc. employees are not permitted to use a power-actuated tool until properly trained as prescribed by the manufacturer.

Extension Cords

See FLD 35, Electric Safety, for requirements and procedures for using extension cords.

SPECIALTY TOOLS

Pneumatic Powered Tools

Tools powered by air must be inspected and maintained as described above. Hose or tubing used to deliver air to pneumatic tools must be used as required and according to procedures in FLD 16, Pressure Systems: Compressed Gas Systems.

Powder-Actuated Tools

- Y Only employees who have been trained in the operation of the particular tool in use shall be allowed to operate a powder-actuated tool.
- Y Powder-actuated tools shall be tested each day before loading to see that safety devices are in proper working condition. The method of testing shall be in accordance with the manufacturer's recommended procedure.
- Y Any tool found not in proper working order, or that develops a defect during use, shall be immediately removed from service and not used until properly repaired.
- Y Personal protective equipment shall be selected in accordance with manufacturer's recommendations and in consideration of the potential hazards of the task.
- Y Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any employees. Hands shall be kept clear of the open barrel end.
- Y Loaded tools shall not be left unattended.
- Y Fasteners shall not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.
- Y Driving into materials easily penetrated shall be avoided unless such materials are backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying missile hazard on the other side.
- Y No fastener shall be driven into a spalled area caused by an unsatisfactory fastening.
- Y Tools shall not be used in an explosive or flammable atmosphere.
- Y All tools shall be used with the correct shield, guard, or attachment recommended by the manufacturer.
- Y Powder-actuated tools used by employees shall meet all other applicable requirements of American National Standards Institute, A10.3-1970, Safety Requirements for Explosive-Actuated Fastening Tools.

RST 3 FLD 43A ANIMALS

Animals represent hazards because of their poisons or venoms, size and aggressiveness, diseases transmitted, or the insects they may carry.

Feral Animals

Landfills and abandoned buildings often attract stray or abandoned dogs. These animals often become pack-oriented, very aggressive, and represent serious risk of harm to unprotected workers.

Workers entering abandoned buildings should be alert for such animals and avoid approaching them since this may provoke aggressive behavior. Avoidance and protection protocols include watching for animal dens, using good housekeeping, and using repellents.

Dangerous Wild Animals

Work in remote areas inhabited by wild animals that have been known to cause injury and kill human beings, requires that companies working in these areas carefully plan for wildlife encounters. This FLD outlines actions that, when properly implemented, should provide a high degree of protection for WESTON employees and wildlife.

See Wildlife Hazard Recognition and Protection Procedure (Attached).

Venomous Snakes and Lizards

Venomous Snakes

Venomous snakes are common around the world. The major variables are the likelihood of encounter and the snake that is likely to be encountered. Encounters with snakes may be caused by moving containers, reaching into holes, or just walking through high grass, swampy areas, or rocks. **Do not attempt to catch any snakes.**

Symptom of venomous snake bites:

- Bloody wound discharge, blurred vision, burning, convulsions, diarrhea, dizziness, excessive sweating, fainting, fang marks in the skin, fever, increased thirst, local tissue death, loss of muscle coordination, nausea and vomiting, numbness and tingling, rapid pulse, severe pain, skin discoloration, swelling at the site of the bite, weakness.

Venom from venomous snakes and lizards can be divided into three types of toxins, however, there are some indications that snake venom may have more than one toxin and characteristics may change as a snake ages. The three types of toxins and their effects are:

Hemotoxins destroy blood cells and affect the circulatory system. The site of the bite rapidly becomes swollen, discolored, and painful. This is usually accompanied by swelling, discoloration, and pain progressing toward the heart.

Neurotoxins affect the nervous system and symptoms vary from foggy vision, dizziness, and other comparatively mild symptoms to rigid or flaccid paralysis, shortness of breath, weakness or paralysis of the lower limbs, double vision, inability to speak or swallow, drooping eyelids, and involuntary tremors of the facial muscles. Death can occur in as little as ten minutes, usually due to abrupt cessation of respiration.

Myotoxins destroy cells and cause muscle necrosis.

In the US, with the exception of the coral snakes which tend to have neuron-toxic venom, most venomous snakes have been categorized as having hemotoxic venom (in some areas Mojave rattlesnakes are found to have neuron-toxic venom). There is some indication that some species of rattlesnakes have both hemotoxic and neuron-toxic venom. It is also reported that venom of younger snakes may be more neuron-toxic.

There are many highly venomous snakes worldwide, some are deadly and most can be deadly without proper care.

Geographical Listing of Venomous Snakes

Following is a list of poisonous snakes by geographic area. This list is extensive but may not be all inclusive. In planning for work around the world, also contact local agencies to determine whether there may be additional venomous snakes or lizards.

North America

Copperheads (Broad-banded, Northern, Osage, Southern, Trans-Pecos)

Rattlesnakes Diamondback (eastern and western), Massasauga (eastern and western)

Cottonmouth or water moccasin (Eastern)

Prevention of Bites

Key factors to working safely in areas where snakes or lizards may be encountered include:

- Be alert
- Use care when reaching into or moving containers
- Use sticks or long-handled tools when reaching where you cannot see
- Be familiar with the habits and habitats of snakes in the vicinity of an incident or site
- In areas or activities where encounters with snakes are likely, wear sturdy leather or rubber work boots and snake chaps
- Do not attempt to catch snakes unless required and qualified

A snake bite warrants medical attention after administration of proper first-aid procedures. It is important to contact local medical facilities to determine where anti-venoms are located.

First-Aid

1. Keep the person calm. Restrict movement, and keep the affected area below heart level to reduce the flow of venom.
2. Remove any rings or constricting items because the affected area may swell. Create a loose splint to help restrict movement of the area.
3. If the area of the bite begins to swell and change color, the snake was probably venomous.
4. Monitor the person's vital signs -- temperature, pulse, rate of breathing, and blood pressure if possible. If there are signs of shock (such as paleness), lay the person flat, raise the feet about a foot, and cover the person with a blanket.
5. Get medical help immediately.
6. Try to photograph or identify the snake. Do not waste time hunting for the snake, and do not risk another bite. Be careful of the head of a dead snake. A snake can actually bite for up to an hour after it is dead (from a reflex).
 - DO NOT allow the person to become over-exerted. If necessary, carry the person to safety.
 - DO NOT apply a tourniquet.
 - DO NOT apply cold compresses to a snake bite.
 - DO NOT cut into a snake bite with a knife or razor.
 - DO NOT try to suction the venom by mouth.
 - DO NOT give stimulants or pain medications unless instructed to do so by a doctor.
 - DO NOT give the person anything by mouth.
 - DO NOT raise the site of the bite above the level of the person's heart
 - Transport the victim to medical attention immediately

Animal Borne Diseases

Rabies

Animal borne diseases include rabies (generally found in dogs, skunks, raccoons, bats, and foxes). Rabies varies from area to area as do the animals most likely to be rabid.

Questions and Answers about Rabies

Q. What is Rabies and how is it transmitted?

A. Rabies is a viral infection most often transmitted by bites of animals infected with the virus.

Q. What animals are most likely to be infected?

A. Skunks, raccoons, foxes, and bats are wild animals most frequently found to be infected with rabies; however, any warm blooded animal can be infected. Squirrels, groundhogs, horses, cattle, and rabbits have been tested positive for rabies. Dogs and cats are frequently rabies-infected if not immunized.

Q. How can you tell if an animal is rabies-infected?

A. Rabies infection is not always apparent. Signs to look for in wild animals are over-aggressiveness or passivity. Spotting animals which are normally nocturnal (active at night) during the day and being able to approach them would be an example of unusual behavior. Finding a bat alive and on the ground is abnormal. The best precaution, however, is to observe wild animals from a safe distance, even if they are injured. Avoid dogs and cats that you do not know.

Q. What should you do if bitten by an animal you suspect is infected with rabies?

A. As quickly as possible, wash the bite area with soap and water, then disinfect with 70% alcohol and seek medical attention for follow-up. Try to capture the animal. Avoid being bitten again or contacting the mouth or any saliva of the animal. Keep the animal under surveillance and call the police for assistance to capture it. Have the animal tested.

A dead animal believed to be infected should be preserved and tested for rabies. Health departments are often sources where information can be found regarding testing.

Q. Is there a cure for rabies?

A. Rabies is preventable, even after being bitten, if treatment is begun soon enough. Getting prompt medical attention and confirming the rabies infection of an animal are very important. **Rabies is not curable once symptoms or signs of rabies appear.**

There are vaccines available that should be considered if a work assignment involves trapping animals likely to carry rabies. Medical consultants must be involved in decisions to immunize workers against rabies.

Hantavirus

WESTON employees or contractors/subcontractors conducting field work in areas where there is evidence of a rodent population should be aware of an increased level of concern regarding the transmission of “Hantavirus”-associated diseases. Hantavirus is associated with rodents, especially the deer mouse (*Peromyscus maniculans*) as a primary reservoir host. Hantavirus has resulted in several deaths in the U.S.

The Hantavirus can be transmitted by infected rodents through their saliva, urine, and feces. Human infection may occur when infected wastes are inhaled as a result of aerosols produced directly from the animals. They also may come from dried materials introduced into broken skin or onto mucous membranes. Infections in humans occur most in adults and are associated with

activities that provide contact with infected rodents in rural/semi-rural areas. Hantavirus begins with one or more flu-like symptoms (i.e., fever, muscle aches, headache, and/or cough) and progresses rapidly to severe lung disease. Early diagnosis and treatment are vital.

Prevention

Personnel involved in work areas where rodents and the presence of the Hantavirus are known or suspected will need to take personal protective measures and to develop an expanded site safety plan.

Field personnel involved in trapping or contacting rodents or their waste products will need to wear respirators with high-efficiency particulate air (HEPA) filters, eye protection, Tyvek coveralls, chemical-resistant gloves, and disposable boot covers. Strict decontamination requirements are needed. Double-bag, label, and specific handling, packaging, shipping, storage, and analytical procedures are required to minimize the risks of exposure from collected mice. More detailed procedures can be obtained from WESTON Corporate Health and Safety.

For employees and facilities in rural/semi-rural areas, the following risk-reduction strategies are appropriate:

- Eliminate rodents and reduce availability of food sources and nesting sites used by rodents.
- Store trash/garbage in rodent-proof metal or thick plastic containers with tight lids.
- Cut all grass/underbrush in proximity to buildings.
- Prevent rodents from entering buildings (e.g., use steel wool, screen, etc., to eliminate openings).

Plague

Described under Insects (Fleas)

Anthrax

Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. Anthrax most commonly occurs in wild and domestic lower vertebrates (cattle, sheep, goats, and other herbivores), but it can also occur in humans when they are exposed to infected animals or tissue from infected animals.

Anthrax is most common in agricultural regions where it occurs in animals. When anthrax affects humans, it is usually due to an occupational exposure to infected animals or their products. Workers who are exposed to dead animals and animal products from other countries where anthrax is more common may become infected with *B. anthracis* (industrial anthrax). Anthrax in wild livestock has occurred in the U.S.

Anthrax infection can occur in three forms: cutaneous (skin), inhalation, and gastrointestinal. *B. anthracis* spores can live in the soil for many years, and humans can become infected with anthrax by handling products from infected animals or by inhaling anthrax spores from contaminated animal products. Anthrax can also be spread by eating undercooked meat from infected animals. It is rare to find infected animals in the U.S.

Cutaneous: Most (about 95%) anthrax infections occur when the bacterium enters a cut or abrasion on the skin, such as when handling contaminated wool, hides, leather, or hair products (especially goat hair) of infected animals. Skin infection begins as a raised itchy bump that resembles an insect bite but within 1-2 days develops into a vesicle and then a painless ulcer, usually 1-3 cm in diameter, with a characteristic black necrotic (dying) area in the center. Lymph glands in the adjacent area may swell. About 20% of untreated cases of cutaneous anthrax will result in death. Deaths are rare with appropriate antimicrobial therapy.

Inhalation: Initial symptoms may resemble a common cold. After several days, the symptoms may progress to severe breathing problems and shock. Inhalation anthrax is usually fatal.

Intestinal: The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting, and fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax results in death in 25% to 60% of cases.

Anthrax is not known to spread from one person to another person. Communicability is not a concern in managing or visiting patients with inhalation anthrax.

Prevention


In countries where anthrax is common and vaccination levels of animal herds are low, humans should avoid contact with livestock and animal products and avoid eating meat that has not been properly slaughtered and cooked. Also, an anthrax vaccine has been licensed for use in humans. The vaccine is reported to be 93% effective in protecting against anthrax.

Doctors can prescribe effective antibiotics. To be effective, treatment should be initiated early. If left untreated, the disease can be fatal.

Direct person-to-person spread of anthrax is extremely unlikely; however, a patient's clothing and body may be contaminated with anthrax spores. Effective decontamination of people can be accomplished by a thorough wash down with anti-microbe effective soap and water. Waste water should be treated with bleach or other anti-microbial agent. Effective decontamination of articles can be accomplished by boiling contaminated articles in water for 30 minutes or longer and using common disinfectants. Chlorine is effective in destroying spores and vegetative cells on surfaces. Burning the clothing is also effective. After decontamination, there is no need to immunize, treat, or isolate contacts of people ill with anthrax unless they also were also exposed to the same source of infection. Early antibiotic treatment of anthrax is essential—delay seriously lessens chances for survival. Treatment for anthrax infection and other bacterial infections

includes large doses of intravenous and oral antibiotics, such as fluoroquinolones, like ciprofloxacin (cipro), doxycycline, erythromycin, vancomycin, or penicillin. In possible cases of inhalation anthrax exposure to unvaccinated personnel, early antibiotic prophylaxis treatment is crucial to prevent possible death.

No skin, especially if it has any wounds or scratches, should be exposed. Disposable personal protective equipment is preferable, but if not available, decontamination can be achieved by washing any exposed equipment in hot water, bleach and detergent. Disposable personal protective equipment and filters should be burned and buried. The size of *Bacillus anthracis* bacilli ranges from 0.5 μm to 5.0 μm . Anyone working with anthrax in a suspected or confirmed victim should wear respiratory equipment capable of filtering this size of particle or smaller. The U.S. National Institute for Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration (MSHA) approved high efficiency-respirator, such as a half-face disposable respirator with a HEPA filter, is recommended. All possibly contaminated bedding or clothing should be isolated in double plastic bags and treated as possible bio-hazard waste. Dead victims that are opened and not burned provide an ideal source of anthrax spores; the victim should be sealed in an airtight body bag. Cremating victims is the preferred way of handling body disposal. No embalming or autopsy should be attempted without a fully equipped biohazard lab and trained and knowledgeable personnel.

Delays of only a few days may make the disease untreatable and treatment should be started even without symptoms if possible contamination or exposure is suspected. Animals with anthrax often just die without any apparent symptoms. Initial symptoms may resemble a common cold – sore throat, mild fever, muscle aches and malaise. After a few days, the symptoms may progress to severe breathing problems and shock and ultimately death. Death can occur from about two days to a month after exposure with deaths apparently peaking at about 8 days after exposure.  Antibiotic-resistant strains of anthrax are known.

Aerial spores can be trapped by a simple HEPA or P100 filter. Inhalation of anthrax spores can be prevented with a full-face mask using appropriate filtration. Unbroken skin can be decontaminated by washing with simple soap and water. All of these procedures do not kill the spores which are very hard to kill and require extensive treatment to eradicate them. Filters, clothes, etc. exposed to possible anthrax contaminated environments should be treated with chemicals or destroyed by fire to minimize the possibility of spreading the contamination.

In recent years there have been many attempts to develop new drugs against anthrax; but the existing supply still works fine if treatment is started soon enough.

Prevention can also be accomplished through early detection. In response to the U.S. Postal Service (USPS) anthrax attacks of October 2001, the USPS has installed BioDetection Systems (BDS) in their large-scale mail cancellation facilities. BDS response plans have been formulated by the USPS in conjunction with local responders including fire, police, hospitals, and public health. Employees of these facilities have been educated about anthrax, response actions and prophylactic medication. Because of the time delay inherent in getting final verification that anthrax has been used, prophylactic antibiotics for possibly exposed personnel should commence as soon as possible.

The ultimate in prevention is vaccination against infection but this has to be done well in advance of exposure.

Anthrax spores can survive for long periods of time in the environment after release. Methods for cleaning anthrax contaminated sites commonly use oxidizing agents such as peroxides, ethylene Oxide, Sandia Foam, chlorine dioxide (used in the Hart Senate office building), and liquid bleach products containing sodium hypochlorite. These agents slowly destroy bacterial spores. A bleach solution for treating hard surfaces has been approved by the EPA and can be prepared by mixing one part bleach (5.25%-6.00%) to one part white vinegar to eight parts water. Bleach and vinegar must not be combined together directly, rather some water must first be added to the bleach (e.g., two cups water to one cup of bleach), then vinegar (e.g., one cup), and then the rest of the water (e.g., six cups). The pH of the solution should be tested with a paper test strip; and treated surfaces must remain in contact with the bleach solution for 60 minutes (repeated applications will be necessary to keep the surfaces wet).

Chlorine dioxide has emerged as the preferred biocide against anthrax-contaminated sites, having been employed in the treatment of numerous government buildings over the past decade. Its chief drawback is the need for *in situ* processes to have the reactant on demand.

To speed the process, trace amounts of a non-toxic catalyst composed of iron and tetra-amido macrocyclic ligands are combined with sodium carbonate and bicarbonate and converted into a spray. The spray formula is applied to an infested area and is followed by another spray containing tertiary-butyl hydroperoxide

Using the catalyst method, a complete destruction of all anthrax spores takes 30 minutes. A standard catalyst-free spray destroys fewer than half the spores in the same amount of time. They can be heated, exposed to the harshest chemicals, and they do not easily die.

Brucellosis

Brucellosis, also called undulant fever or Malta fever, is a zoonosis (infectious disease transmitted from animals to humans) caused by bacteria of the genus *Brucella*. It is primarily a disease of domestic animals (goats, pigs, cattle, dogs, etc.) and humans and has a worldwide distribution.

Although brucellosis can be found worldwide, it is more common in countries that do not have good standardized and effective public health and domestic animal health programs. Areas currently listed as high risk include the Caribbean.

The disease is transmitted either through contaminated or untreated milk (and its derivatives) or through direct contact with infected animals, which may include dogs, pigs, camels, and ruminants, primarily sheep, goats, cattle, and bison. This also includes contact with their carcasses.

Leftovers from parturition are also extremely rich in highly virulent brucellae. Brucellae, along with leptospira have the unique property of being able to penetrate through intact human skin, so infection by mere hand contact with infectious material is likely to occur.

The disease is now usually associated with the consumption of un-pasteurized milk and soft cheeses made from the milk of infected animals and with occupational exposure of veterinarians and slaughterhouse workers. Some vaccines used in livestock, most notably *B. abortus* strain 19 also cause disease in humans if accidentally injected. Problems with vaccine induced cases in the United States declined after the release of the RB-51 strain developed in the 1990s and the relaxation of laws requiring vaccination of cattle in many states.

The incubation period of brucellosis is, usually, of one to three weeks, but some rare instances may take several months to surface.

Brucellosis induces inconstant fevers, sweating, weakness, anemia, headaches, depression and muscular and bodily pain.

The symptoms are like those associated with many other febrile diseases, but with emphasis on muscular pain and sweating. The duration of the disease can vary from a few weeks to many months or even years. In first stage of the disease, septicaemia occurs and leads to the classic triad of undulant fevers, sweating (often with characteristic smell, likened to wet hay) and migratory arthralgia and myalgia.

Prevention

The main way of preventing brucellosis is by using fastidious hygiene in producing raw milk products, or by pasteurization of all milk that is to be ingested by human beings, either in its pure form or as a derivate, such as cheese.

Provide protection from skin contact when handling potentially infected animals.

Q fever

Q fever is caused by infection with *Coxiella burnetii*. This organism is uncommon but may be found in cattle, sheep, goats and other domestic mammals, including cats and dogs. The infection results from inhalation of contaminated particles in the air, and from contact with the vaginal mucus, milk, feces, urine or semen of infected animals. The incubation period is 9-40 days. It is considered possibly the most infectious disease in the world, as a human being can be infected by a single bacterium.

The most common manifestation is flu-like symptoms with abrupt onset of fever, malaise, profuse perspiration, severe headache, myalgia (muscle pain), joint pain, loss of appetite, upper respiratory problems, dry cough, pleuritic pain, chills, confusion and gastro-intestinal symptoms such as nausea, vomiting and diarrhea. The fever lasts approximately 7-14 days.

During the course, the disease can progress to an atypical pneumonia, which can result in a life threatening acute respiratory distress syndrome (ARDS), whereby such symptoms usually occur during the first 4-5 days of infection.

Less often the Q fever causes (granulomatous) hepatitis which becomes symptomatic with malaise, fever, liver enlargement (hepatomegaly), pain in the right upper quadrant of the abdomen and jaundice (icterus).

The chronic form of the Q fever is virtually identical with the inflammation of the inner lining of the heart (endocarditis), which can occur after months or decades following the infection. It is usually deadly if untreated. However, with appropriate treatment this lethality is around 10%.

The common way of infection is inhalation of contaminated dust, contact with contaminated milk, meat, wool and particularly birthing products. Ticks can transfer the pathogenic agent to other animals. Transfer between humans seems extremely rare and has so far been described in very few cases.

Prevention

Q fever is effectively prevented by intradermal vaccination with a vaccine composed of killed *Coxiella burnetii* organisms. Skin and blood tests should be done before vaccination to identify preexisting immunity; the reason is that vaccinating subjects who already have immunity can result in a severe local reaction. After a single dose of vaccine, protective immunity lasts for many years. Revaccination is not generally required. Annual screening is typically recommended.

Wear appropriate PPE when handling potentially infected animals or materials.

Leptospirosis

Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*.

The time between a person's exposure to a contaminated source and becoming sick is 2 days to 4 weeks. Illness usually begins abruptly with fever and other symptoms. Leptospirosis may occur in two phases; after the first phase, with fever, chills, headache, muscle aches, vomiting, or diarrhea, the patient may recover for a time but become ill again. If a second phase occurs, it is more severe; the person may have kidney or liver failure or meningitis. This phase is also called Weil's disease.

The illness lasts from a few days to 3 weeks or longer. Without treatment, recovery may take several months. In rare cases death occurs.

Many of these symptoms can be mistaken for other diseases. Leptospirosis is confirmed by laboratory testing of a blood or urine sample.

Leptospira organisms have been found in cattle, pigs, horses, dogs, rodents, and wild animals. Humans become infected through contact with water, food, or soil containing waste from these infected animals. This may happen by consuming contaminated food or water or through skin contact, especially with mucosal surfaces, such as the eyes or nose, or with broken skin. The disease is not known to be spread from person to person.

Leptospirosis occurs worldwide but is most common in temperate or tropical climates. It is an occupational hazard for many people who work outdoors or with animals, for example, farmers, sewer workers, veterinarians, fish workers, dairy farmers, or military personnel. It is a recreational hazard for campers or those who participate in outdoor sports in contaminated areas and has been associated with swimming, wading, and whitewater rafting in contaminated lakes and rivers. The incidence is also increasing among urban children.

The risk of acquiring leptospirosis can be greatly reduced by not swimming or wading in water that might be contaminated with animal urine.

Protective clothing or footwear should be worn by those exposed to contaminated water or soil because of their job or recreational activities.

Prevention

Avoid risky foods and drinks.

Buy it bottled or bring it to a rolling boil for 1 minute before drink it. Bottled carbonated water is safer than non-carbonated water.

Ask for drinks without ice unless the ice is made from bottled or boiled water. Avoid popsicles and flavored ices that may have been made with contaminated water.

Eat foods that have been thoroughly cooked and that are still hot and steaming

Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to wash well. When eating raw fruit or vegetables that can be peeled, peel them yourself. (Wash your hands with soap first.) Do not eat the peelings.

Avoid foods and beverages from street vendors. It is difficult for food to be kept clean on the street, and many travelers get sick from food bought from street vendors.

Leptospirosis is treated with antibiotics, such as doxycycline or penicillin, which should be given early in the course of the disease. Intravenous antibiotics may be required for persons with more severe symptoms. Persons with symptoms suggestive of leptospirosis should contact a health care provider.

Ebola

Ebola is both the common term used to describe a group of viruses belonging to genus Ebolavirus, family Filoviridae, and the common name for the disease which they cause, Ebola hemorrhagic fever. Ebola viruses are morphologically similar to the Marburg virus, also in the family Filoviridae, and share similar disease symptoms. Ebola has caused a number of serious and highly publicized outbreaks since its discovery.

Despite considerable effort by the World Health Organization, no animal reservoir capable of sustaining the virus between outbreaks has been identified. However, it has been hypothesized that the most likely candidate is the fruit bat.

Ebola hemorrhagic fever is potentially lethal and encompasses a range of symptoms including fever, vomiting, diarrhea, generalized pain or malaise, and sometimes internal and external bleeding. Mortality rates are extremely high, with the human case-fatality rate ranging from 50% - 89%, according to viral subtype.^[2] The cause of death is usually due to hypovolemic shock or organ failure.

Because Ebola is potentially lethal and since no approved vaccine or treatment is available, Ebola is classified as a biosafety level 4 agent, as well as a Category A bioterrorism agent by the Centers for Disease Control and Prevention.

Symptoms are varied and often appear suddenly. Initial symptoms include high fever (at least 38.8°C), severe headache, muscle joint, or abdominal pain, severe weakness and exhaustion, sore throat, nausea, and dizziness. Before an outbreak is suspected, these early symptoms are easily mistaken for malaria, typhoid fever, dysentery, influenza, or various bacterial infections, which are all far more common and less reliably fatal.

Ebola may progress to cause more serious symptoms, such as diarrhea, dark or bloody feces, vomiting blood, red eyes due to distention and hemorrhage of sclerotic arterioles, petechia, maculopapular rash, and purpura. Other secondary symptoms include hypotension (less than 90 mm Hg systolic /60 mm Hg diastolic), hypovolemia, tachycardia, organ damage (especially the kidneys, spleen, and liver) as a result of disseminated systemic necrosis, and proteinuria. The interior bleeding is caused by a chemical reaction between the virus and the platelets which creates a chemical that will cut cell sized holes into the capillary walls.

Among humans, the virus is transmitted by direct contact with infected body fluids, or to a lesser extent, skin or mucus membrane contact. The incubation period can be anywhere from 2 to 21 days, but is generally between 5 and 10 days.

Although airborne transmission between monkeys has been demonstrated by an accidental outbreak in a laboratory located in Virginia, USA, there is very limited evidence for human-to-human airborne transmission in any reported epidemics.

The infection of human cases with Ebola virus has been documented through the handling of infected chimpanzees, and gorillas--both dead and alive.

So far, all epidemics of Ebola have occurred in sub-optimal hospital conditions, where practices of basic hygiene and sanitation are often either luxuries or unknown to caretakers and where disposable needles and autoclaves are unavailable or too expensive. In modern hospitals with disposable needles and knowledge of basic hygiene and barrier nursing techniques, Ebola rarely spreads on such a large scale.

Prevention

Prevention methods include good hygiene in medical settings and awareness of the virus in travel areas. There is no known effective vaccine for humans.

Prevention efforts should concentrate on avoiding contact with host or vector species. Travelers should not visit locations where an outbreak is occurring. Contact with rodents should be avoided. Minimize exposure to arthropod bites by using permethrin-impregnated bed nets and insect repellents.

Strict compliance with infection control precautions (i.e., use of disposable gloves, face shields, and disposable gowns to prevent direct contact with body fluids and splashes to mucous membranes when caring for patients or handling clinical specimens; appropriate use and disposal of sharp instruments; hand washing and use of disinfectants) is recommended to avoid health care-associated infections.

Contact with dead primates should be avoided.

Bird and Bat Borne or Enhanced Diseases

See also under Molds and Fungus

Histoplasmosis

Histoplasmosis is a fungal infection which enters the body through the lungs. The infection enters the body through the lungs. The fungus grows as a mold in the soil, and infection results from breathing in airborne particles. Soil contaminated with bird or bat droppings are known to have a higher concentration of histoplasmosis.

There may be a short period of active infection, or it can become chronic and spread throughout the body. Most people who do develop symptoms will have a flu-like syndrome (acute-fever, chills cough, and chest pain; chronic-chest pain, cough with blood, fever, shortness of breath, sweating) and lung complaints related to pneumonia or other lung involvement. Approximately 10% of the population will develop inflammation in response to the initial infection. This can affect the skin, bones or joints, or the lining of the heart (pericardium). These symptoms are not due to fungal infection of those body parts, but due to inflammation.

In a small number of patients, histoplasmosis may become widespread (disseminated) and involve the blood, brain, adrenal glands, or other organs. Very young or old are at a higher risk for

disseminated histoplasmosis. Symptoms include fevers, headache, neck stiffness, mouth sores, skin lesions.

Histoplasmosis may be prevented by reducing dust exposure in areas containing bird or bat droppings. Wear PPE and respirator when working within this environment. Institute work practices and dust control measures, i.e. moist/wet area, that eliminate or reduce dust generation which will reduce risks of infection and subsequent development of disease.

Treatment

The main treatment for histoplasmosis is antifungal drugs. Amphotericin B, itraconazole, and ketoconazole are the usual treatments. Long-term treatment with antifungal drugs may be needed.

Psittacosis

Psittacosis is a disease caused by a bacteria that is found in bird droppings and other secretions (often carried by pet birds). The bacteria is found worldwide.

Symptoms of psittacosis infection may include a low-grade fever that often becomes worse as the disease progresses, including anorexia, sore throat, light sensitivity, and a severe headache.

Ammonia and sodium hypochlorite based disinfectants are effective disinfectants for Psittacosis.

Where it is necessary to remove bat droppings from buildings prior to renovation or demolition it is prudent to assume infection and use the following precautions:

- Avoid areas that may harbor the bacteria, e.g., accumulations of bird or bat droppings.
- Areas known or suspected of being contaminated by *the organisms causing* Psittacosis such as bird roosts, attics, or even entire buildings that contain accumulations of bat or bird manure, should be posted with signs warning of the health risk. The building or area should be secured
- Before an activity is started that may disturb any material that might be contaminated by Psittacosis, workers should be informed in writing of the personal risk factors that increase an individual's chances of developing these diseases. Such a written communication should include a warning that individuals with weakened immune systems are at the greatest risk of developing severe forms of these diseases become infected. These people should seek advice from their health care provider about whether they should avoid exposure to materials that might be contaminated with these organisms.

The best way to prevent exposure is to avoid situations where material that might be contaminated can become aerosolized and subsequently inhaled. A brief inhalation exposure

highly contaminated dust may be all that is needed to cause infection and subsequent development of psittacosis. Therefore, work practices and dust control measures that eliminate or reduce dust generation during the removal of bat manure from a building will also reduce risks of infection and subsequent development of disease. For example, instead of shoveling or sweeping dry, dusty material, carefully wetting it with a water spray can reduce the amount of dust aerosolized during an activity. Adding a surfactant or wetting agent to the water might reduce further the amount of aerosolized dust.

Once the material is wetted, it can be collected in double, heavy-duty plastic bags, a 55-gallon drum, or some other secure container for immediate disposal. An alternative method is use of an industrial vacuum cleaner with a high-efficiency filter to *bag* contaminated material. Truck-mounted or trailer-mounted vacuum systems are recommended for buildings with large accumulations of bat or bird manure. These high-volume systems can remove tons of contaminated material in a short period. Using long, large-diameter hoses, such a system can also remove contaminated material located several stories above its waste hopper. This advantage eliminates the risk of dust exposure that can happen when bags tear accidentally or containers break during their transfer to the ground.

The removal of all material that might be contaminated from a building and immediate waste disposal will eliminate any further risk that someone might be exposed to aerosolized spores. Air sampling, surface sampling, or the use of any other method intended to confirm that no infectious agents remain following removal of bat manure is unnecessary in most cases. However, before a removal activity is considered finished, the cleaned area should be inspected visually to ensure that no residual dust or debris remains.

Spraying 1:10 bleach to water mixture on droppings and allowing it to dry is also a recommended practice for the psittacosis organisms.

Because work practices and dust control measures to reduce worker exposures to these organisms have not been fully evaluated, using personal protective equipment is still necessary during some activities. During removal of an accumulation of bat or bird manure from an enclosed area such as an attic, dust control measures should be used, but wearing a NIOSH-approved respirator and other items of personal protective equipment is also recommended to reduce further the risk of exposure to the organisms that cause Psittacosis.

Treatment

Psittacosis is often hard to diagnoses and while a concern, it does not occur with great frequency. Knowledge of the symptoms and of potential exposure is important when seeking medical follow-up for potential exposure.

There are various medical treatments for psittacosis based on extent of infection. The sooner the disease is diagnosed and treatment is begun the more effective the treatment will be.

APPENDIX A

Dangerous Animals - Wildlife Hazard Recognition and Protection

GENERAL

Work in remote areas inhabited by wild animals that have been known to cause injury and kill human beings, requires that companies working in these areas carefully plan for wildlife encounters. This procedure outlines actions that when properly implemented should provide a high degree of protection for employees and wildlife.

These procedures apply to employees who prepare Health and Safety Plans or perform fieldwork in environments in which wild animals may be encountered. However, due to the unpredictable nature of wild animals this single document cannot possibly cover all potential risks or protective measures. Therefore, prior to entering remote areas inhabited by dangerous wildlife, contact local wildlife agencies to gather additional information concerning local risks and protective measures.

ATTACHMENTS

Attachments 1 and 2 outline behavioral characteristics of and outline controls that will minimize human injury, loss of property, and unnecessary destruction of wildlife, while ensuring a safe work environment.

WILDLIFE AVOIDANCE AND BASIC PROTECTIVE MEASURES

The best protective measure is simply avoidance. Large numbers of humans present deterrence to wild animals; therefore, whenever possible teams in the field should work together in groups of four or more. Whenever practical, fieldwork should be scheduled around the seasonal cycles of wildlife in the area. When wild animal avoidance cannot be achieved through scheduling, personnel involved in field activities in which encounters with wild animals may result, will take the following steps and will be equipped and trained, as set forth below.

CLEAR THE AREA

Evaluate and control the area before entry by

- Determine areas of recent sightings through local Fish and Game, state troopers, etc.;
- Conduct a site observation from an off-site elevated point, if possible;
- Conduct a controlled walk through in the area by a trained observer;
- Arrange a briefing by a local specialist, e. g., Fish and Game, etc.; and
- Utilizing appropriate noisemakers.

BASIC EQUIPMENT

Employees entering an environment where encounters with wild animals are possible should be provided, as a minimum:

- Noisemakers, such as air horns, bells, etc.; and
- Bear spray of not less than 16-ounce capacity (with holster), equivalent to capsicum pepper (red pepper extract), which is capable of spraying at least 15 feet. (Notes: Normally cannot be transported in side aircraft passenger compartments and may be

considered a hazardous material, check with airlines and hazardous material shippers for current information).

TRAINING

Prior to entering and / or working in areas inhabited by dangerous wildlife each employee should receive training as outlined in this procedure. At a minimum, training must include information related to:

- Wildlife present, habitat, behavior patterns, including when wild animals are most active, etc.
- Warning signs, such as tracks, bedding areas, scat, claw marks, offspring, paths, etc.,
- Avoidance measures
- Other hazards, precautions, and protective measures as outlined in the Attachments,
- (At the jobsite) spray demonstration and safety instructions which include location of and persons designated as “bear watch”

An outline of the training content should be reviewed and approved by the Divisional EHS manager and should be documented. A record of the training will be maintained at the job site, filed with the SSHSP and in the employee’s training records.

VEHICLE SAFETY

Use extreme caution, particularly in darkness, when operating vehicles in areas where wild animals may be present. Collisions with large animals have been known to cause significant property damage and personal injuries to vehicle passengers, including fatalities.

ATTACHMENT 1

BEAR SAFETY – HAZARD RECOGNITION AND PRECAUTIONS

On occasion fieldwork may be conducted in a location where bears may be encountered. The following technical information, precautions, and guidelines for operations in which bears could be encountered are based on experience and conditions for field work. Bears are intelligent, wild animals and are potentially dangerous, and would rather be left alone. The more bears are understood the less they will be feared. This attachment is intended to provide information that will enable Weston to plan for bear encounters and to properly address face-to-face encounters.

Bear Life History

Although bears are creatures of habit, they are also intelligent, and each has its own personality. The way a bear reacts is often dictated by what it has learned from its mother, the experience it has had on its own, and the instincts nature has provided. Like other intelligent animals, we can make general statements about bears, but few people can accurately predict their behavior.

Bears have an incredible sense of smell, and seem to trust it more than any other sense. Hearing and sight are also important, but to a lesser degree. A bear's hearing is probably better than ours, but not as keen as a dog's hearing. Their sight is probably comparable to that of a human. Black bears tend to favor forested habitats.

Bears are opportunists, relying on their intelligence and their senses to find food. They use different habitats throughout the year, depending on the availability of food and other necessities. The area a bear covers in a given year is partially dependent on how far it has to go to satisfy these basic needs. In some areas, individual bears have home ranges of less than a square mile; in other areas ranges can encompass hundreds of square miles. Males usually range over larger areas than females.

In spring, bears begin coming out of hibernation. Males are usually the first bears to emerge, usually in April, and females with new cubs are usually the last, sometimes as late as late June. When bears emerge from their dens, they are lethargic for the first few days, frequently sleeping near their dens and not eating. When they do start eating, they seek carrion (deer, etc.), roots, and emerging vegetation. In coastal areas, beaches become travel corridors as bears seek these foods.

In early summer, bears eat new grasses and forage as they develop in higher elevations. In coastal areas, salmon are the most important food from June through September. This period is one of the few times that bears are found in large groups, and it is the time that most people see bears. Bears often travel, eat, and sleep along streams for weeks at a time.

Other summer foods for bears include grasses and ground squirrels. When bears kill or scavenge large prey, they commonly cover the portions they cannot eat with sticks and duff. A bear may remain near a food cache for days and it will defend it from intruders.

During the late summer and early fall, bears move inland and consume large amounts of blueberries, and other succulent fruits. As the seasons progress towards winter, a bear's diet becomes more varied. This is the time that bears are adding final deposits of fat before their long winter naps.

In October and November, bears move into their denning areas and begin preparing a suitable den. Black bears usually den in holes under large trees or rock outcrops, or in small natural cavities. Dens are just large enough for the bears to squeeze into. Bears rarely eat, drink, urinate, or defecate while they are denning. They sleep deeply, but do not truly hibernate, and they can be awakened by loud noises or disturbances.

Cubs are born in the den, usually in January. Black bear cubs usually stay with their mothers for a year and a half. Black bears are sexually mature at age 2. Mating season is in the spring (May or June) and both species are polygamous (multiple mates). Black bears can live for 25 – 30 years, although most live less than 20 years.

BEAR AND HUMAN INTERACTIONS

Bears generally prefer to be left alone, but they share their homes with other creatures, including humans, who intrude on virtually every aspect of the bear's life. Bears are normally tolerant of these activities and generally find a secure way to avoid them. Humans can help bears make a graceful retreat and avoid many close encounters by letting them know we are coming. Walking in groups, talking, and wearing noise making devices, such as bear bells, all serve to warn a bear of your approach. When possible, avoid hiking and camping in areas where bears are common, such as bear trails through heavy brush or along salmon streams. Always keep an eye out for bears and bear signs. If you happen upon a dead animal, especially one that is covered with sticks and duff (a bear cache), immediately retreat the way you came, but do not run, and make a detour around the area. If you see a cub up a tree or a small bear walking alone, immediately retreat and detour around the area. Like all young animals, cubs wander away from their mothers, but females are furiously protective when they believe their cubs are threatened. Even if we do everything possible to avoid meeting a bear, sometimes bears come to us.

Bears are both intelligent and opportunistic, and they express these qualities through their curiosity. This curiosity frequently brings them into "human habitat." When this happens, we often feel vulnerable, and the bear is sometimes viewed as a threat or nuisance. In most cases, a curious bear will investigate a "human sign," perhaps test it out (chew on a raft, bite into some cans, etc.), and leave, never to return. If the bear was rewarded during his investigation by finding something to eat, it is hard to stop them from returning once they have had a food-reward. That is why we emphasize the importance of keeping human food and garbage away from bears. When in bear country, always think about the way you store, cook, and dispose of your food. **Never feed bears!** This is both illegal and foolish. Food should be stored in airtight containers, preferably away from living and sleeping areas. Garbage should be thoroughly incinerated as soon as possible. Fish and game should be cleaned well away from camp, and clothing that smells of fish and game should be stored away from sleeping areas. Menstruating women should take extra precautions to keep themselves as clean as possible, and soiled tampons and pads should

be treated as another form of organic garbage. Once a bear has obtained food from people, it may continue to frequent areas occupied by people. If a bear does not find food or garbage after the next few tries, it may give up and move back into a more natural feeding pattern. Occasionally, though, the bear will continue to seek human foods and can become a “problem bear.” Some bears become bold enough to raid campsites and break into cabins to search for human food. Shooting bears in the rump with cracker shells, flares, rubber bullets, and birdshot are common methods of “aversive conditioning.” These are also very dangerous techniques, because they may seriously injure a bear if not done properly and/or they may cause a bear to attack the shooter.

BLACK BEARS

Black Bear Identification: Black bears are the smallest and most abundant of the bear species. They are five to six feet long and stand about two to three feet high at the shoulders. They weigh from 200 to 500 pounds. While they are most commonly black, other color phases include brown (cinnamon), and, rarely, gray (blue), and white. Muzzles are usually brown. Black bears can be distinguished from brown bears by:

- Their head shape (a black bear’s nose is straight in profile, a brown bear’s is dished);
- Their claws (black bear’s claws are curved and smaller, brown bears are relatively straight and longer);
- Their body shape (when standing, a black bear’s rump seems to be higher than its shoulders; a brown bear’s shoulders are usually higher than its rump); and

Typical Habitat: Black bears occupy a wide range of habitats, but seem to be most common in forested areas.

AVOIDING BEAR ENCOUNTERS WHEN

- The Bear sees you but you do not know the bear is around: The bear will likely avoid detection people and will simply move away when they sense a human.
- You see a bear and it does not know you are there: Move away slowly. Avoid intercepting the bear if it is walking. If possible, detour around the bear. If the bear is close to you, stand where you are or back away slowly. Do not act threateningly toward the bear, it may know you are there but it has chosen to ignore you as long as you are not a threat.
- You see the bear and the bear sees you: Do not act threateningly, but let the bear know you are human. Wave your arms slowly, talk in a calm voice, and walk away slowly in a lateral direction, keeping an eye on the bear. Unless you are very close to a car or a building, never run from bears. In a bear’s world, when something runs it is an open invitation to chase it. Bears will chase a running object even if they have no previous intention of catching it. Bears can run as fast as a racehorse, so humans have little or no chance of outrunning a bear.
- You see a bear; the bear sees you and stands on its hind legs: This means that the bear is seeking more information. Bears stand on their hind legs to get a better look, or smell, at something they are uncertain of. It is your cue to help it figure

out what you are. Help the bear by waving your arms slowly and talking to it. Standing is not a precursor to an attack. Bears do not attack on their hind legs. It is also important to remember that when a bear goes back down on all fours from a standing position, it may come towards you a few steps. This is normal, and probably not an aggressive act.

- The bear sees you, recognizes you as a human, but continues to come towards you slowly: This may mean several things, depending on the bear and the situation. It may mean that the bear does not see you as a threat, and just wants to get by you (especially if the bear is used to humans, as in a National Park); the bear wants to get food from you (if it has gotten food from people before); the bear wants to test your dominance (it views you as another bear); or may be stalking you as food (more common with black bear, but a rare occurrence). In all cases, your reaction should be to back off the trail very slowly, stand abreast if you are in a group, talk loudly, and/or use a noise-making device. If the bear continues to advance, you should stop. At this point, it is important to give the bear the message that if he continues to advance it will cost him. Continue to make loud noises and present a large visual image to the bear (standing abreast, open your coat). In bear language, bears assert themselves by showing their size. If an adult brown bear continues to come at you, climbing 20 feet or higher up a tree may also be an option if one is next to you (remember, never run from bears). Keep in mind, though, black bears can climb trees.
- The bear recognizes you as a human and acts nervous or aggressive: When bears are nervous or stressed they can be extremely dangerous. This is when it is important to try to understand what is going on in the bears mind. Nervous bears growl, woof, make popping sounds with their teeth, rock back and forth on their front legs, and often stand sideways to their opponent. A universal sign of a nervous bear is excessive salivation (sometimes it looks like they have white lips). When a bear shows any of these signs, stand where you are and talk in a calm voice. Do not try to imitate bear sounds, this may only serve to confuse and further agitate the bear. If you are in a group, stand abreast.
- The bear charges: If all other signals fail, a bear will charge. Surprisingly, most bear charges are just another form of their language. The majority of these are “bluff charges,” that is; the bear stops before making contact with their opponent. There are many different types of bluff charges ranging from a loping uncertain gait to a full-blown charge. If a bear charges, stand still.
- The bear attacks: When all else fails, a bear may attack. Attacks may be preceded by all of the behaviors previously described or they may be sudden. Seemingly unprovoked attacks are often the result of a bear being surprised (and feeling threatened), a bear defending its food cache, or a female defending her cubs. When a bear attacks, it typically runs with its body low to the ground, legs are stiff, ears are flattened, hair on the nape of the neck is up, and the bear moves in a fast, determined way. Front paws are often used to knock the opponent down and jaws are used to subdue it.

AFTER A BEAR ENCOUNTER

Black bears have been known to view humans as prey, and if you struggle with the attacking black bear, it will probably go elsewhere for its meal.

- Bear Sprays: Are easy to carry and use, little risk of permanent damage to bears and humans, effective in many situations. However, using a spray may change a false charge into a real charge, they are ineffective at ranges greater than 20 feet, ineffective in windy conditions, dangerous if accidentally discharged in a closed area such as an aircraft cockpit.

The most effective tool you have against an attacking bear is your brain. Although bears are intelligent animals, we are smarter and can often think our way out of a bad situation if we try.

ATTACHMENT 2

HAZARDS AND PRECAUTIONS – DEER

The following technical information, precautions, and guidelines for operations in which Deer may be encountered. The more the species are understood, the easier it will be to avoid contact with them thus preventing injury to ourselves and to the animals. All big game species are unpredictable and can be dangerous under certain conditions. This attachment is intended to provide information that will enable Weston to plan for encounters and to properly address face-to-face encounters.

WHITE-TAILED DEER

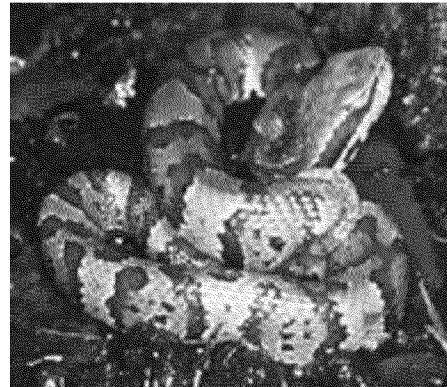
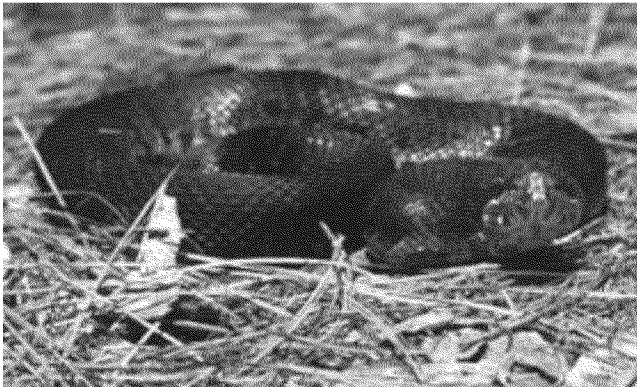
The White-tailed deer found throughout the eastern and western part of the United States have been known to attack people on many occasions. It is unknown whether Black-tailed deer have made any such attacks, but it is possible for someone to be injured by an irate buck in the breeding season (late fall). Deer are well equipped to injure humans. They are very fast. Bucks have sharp antlers and can clear amazingly high obstacles with graceful, arching leaps. They can run with remarkable speed, even in dense cover, and have excellent camouflage. When working in areas populated with deer, it is just common sense not to approach any large wild animal too closely. It is unlikely that an attack from a deer would be fatal but it is possible and serious injury is likely.

APPENDIX B - PICTURES OF POISONOUS SNAKES AND LIZARDS

Americas



American copperhead



Cotton Mouth – East and Southeast US



Timber Rattlesnake – Eastern US

FLD 43 B INSECTS

Sting and Biting Insects

Contact with stinging insects may result in site personnel experiencing adverse health affects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. These include the following:

- Bees (Honeybees, bumble bees, wasps, and hornets and wingless wasps)
- Scorpions
- Fire ants
- Spiders
- Ticks
- Deer Flies
- Mosquito
- Fleas
- Bed Bugs

Bees, Wasps, Hornets and Yellow Jackets

The severity of an insect sting reaction varies from person to person. A normal reaction will result in pain, swelling and redness confined to the sting site. Simply disinfect the area (washing with soap and water will do) and apply ice to reduce the swelling.

A large local reaction will result in swelling that extends beyond the sting site. For example, a sting on the forearm could result in the entire arm swelling twice its normal size.

Although alarming in appearance, this condition is often treated the same as a normal reaction. An unusually painful or very large local reaction may need medical attention. Because this condition may persist for two to three days, antihistamines and corticosteroids are sometimes prescribed to lessen the discomfort.

Yellow jackets, hornets and wasps can sting repeatedly. Honeybees have barbed stingers that are left behind in their victim's skin. These stingers are best removed by a scraping action, rather than a pulling motion, which may actually squeeze more venom into the skin.

Scorpions (Caribbean)

Scorpion stings are a major public health problem in many underdeveloped tropical countries. For every person killed by a poisonous snake, 10 are killed by a poisonous scorpion. In the United States, only 4 deaths in 11 years have occurred as a result of scorpion stings. Furthermore, scorpions can be found outside their normal range of distribution, ie, when they

accidentally crawl into luggage, boxes, containers, or shoes and are unwittingly transported home via human travelers.

Out of 1,500 scorpion species, 50 are dangerous to humans. Scorpion stings cause a wide range of conditions, from severe local skin reactions to neurologic, respiratory, and cardiovascular collapse.

Almost all of these lethal scorpions belong to the scorpion family called the Buthidae. The Buthidae are small to mid-size scorpions (0.8 inch to 5.0 inches) and normally uniformly colored without patterns or shapes. Poisonous scorpions also tend to have weak-looking pincers, thin bodies, and thick tails, as opposed to the strong heavy pincers, thick bodies, and thin tails seen in nonlethal scorpions. The lethal members of the Buthidae family include the genera of *Tityus* which can be found in the Caribbean.

A scorpion has a flattened elongated body and can easily hide in cracks. Scorpions are members of the Arachnid (spider) family. The bodies consist of 3-segments, they also have 4 pairs of legs, a pair of claws, and a segmented tail that has a poisonous spike at the end. Scorpions vary in size from 1-20 cm in length.

However, scorpions may be found outside their habitat range of distribution when inadvertently transported with luggage and cargo.

Prevention

Preventive measures include awareness of scorpions, shaking out clothing and boots before putting them on looking before reaching into likely hiding places and wearing gloves, long sleeved shirts and pants.

Symptoms

In mild cases, the only symptom may be a mild tingling or burning at site of sting.

In severe cases, symptoms may include:

- Eyes and ears - Double vision
- Lungs - Difficulty breathing, No breathing, Rapid breathing,
- Nose, mouth, and throat – Drooling, Spasm of the voice box, Thick-feeling tongue
- Heart and blood - High blood pressure, Increased or decreased heart rate, Irregular heartbeat
- Kidneys and bladder Urinary incontinence, Urine output, decreased
- Muscles and joints - Muscle spasms
- Nervous system – Paralysis, Random movements of head, eye, or neck, Restlessness, Seizures, Stiffness
- Stomach and intestinal tract - Abdominal cramps, Fecal incontinence
- Other -Convulsions

Treatment

1. Recognize scorpion sting symptoms:
2. Wash the area with soap and water.
3. Apply a cool compress on the area of the scorpion sting. Ice (wrapped in a washcloth or other suitable covering) may be applied to the sting location for 10 minutes. Remove compress for 10 minutes and repeat as necessary.
4. Call the Poison Control Center. If you develop symptoms of a poisonous scorpion sting, go to the nearest emergency care facility.
5. Keep your tetanus shots and boosters current.

Fire Ants (Caribbean)

Fire ants are aggressive, reddish-brown to black ants that are 1/8 inch to 1/4 inch long. They construct nests, which are often visible as dome-shaped mounds of soil, sometimes as large as 3 feet across and 1 1/2 feet in height. In sandy soils, mounds are flatter and less visible. Fire ants usually build mounds in sunny, open areas such as lawns, pastures, cultivated fields and meadows, but they are not restricted to these areas. Mounds or nests may be located in rotting logs, around trees and stumps, under pavement and buildings, and occasionally indoors.

Fire ants use their stingers to immobilize or kill prey and to defend ant mounds from disturbance by larger animals, such as humans. Any disturbance sends hundreds of workers out to attack anything that moves. The ant grabs its victim with its mandibles (mouthparts) and then inserts its stinger. The process of stinging releases a chemical, which alerts other ants, inducing them to sting. In addition, one ant can sting several times without letting go with its mandibles.

Once stung, humans experience a sharp pain that lasts a couple of minutes, then after a while the sting starts itching and a welt appears. Fire ant venom contains alkaloids and a relatively small amount of protein. The alkaloids kill skin cells; this attracts white blood cells, which form a pustule within a few hours of being stung. The fluid in the pustule is sterile, but if the pustule is broken, the wound may become infected. The protein in the venom can cause allergic reactions that may require medical attention.

Some of the factors related to stinging insects that increase the risk associated with accidental contact are:

- The nests for these insects are frequently found in remote wooded or grassy areas and hidden in cavities
- The nests can be situated in trees, rocks, bushes or in the ground, and are usually difficult to see
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling which can leave the worker incapacitated and in need of medical attention

- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure, therefore, even if someone has been stung previously, and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again

With these things in mind, and with the high probability of contact with stinging insects, use the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp or hornet stings, inform the site Safety officer of this condition prior to participation in site activities
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the Site Safety officer if a stinging insect nest is located or suspected in the area
- Any nests located on site will be flagged off and site personnel will be notified of its presence
- If attacked, site personnel will immediately seek shelter and stay there. Do not jump in water (bees will still be in the area when you come up). Once safe, remove stings from your skin, it does not matter how you do it, but do it as quickly as possible to reduce the amount of venom they inject. Obtain first aid treatment and contact the safety officer who will observe for signs of allergic reaction

Treatment for fire ant stings is aimed at preventing secondary bacterial infection, which may occur if the pustule is scratched or broken. Clean the blisters with soap and water to prevent secondary infection. Do not break the blister. Topical corticosteroid ointments and oral antihistamines may relieve the itching associated with these reactions.

Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times

Spiders

A large variety of spiders may be encountered during site activities. Extreme caution must be used when lifting logs and debris, since spiders are typically found in these areas.

While most spider bites merely cause localized pain, swelling, reddening, and in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological affects caused by their venom, are dangerous.

Black Widow: The black widow is a coal-black bulbous spider 3/4 to 1 1/2 inches in length, with a bright red hourglass on the under side of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

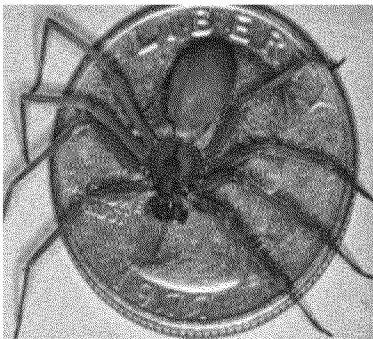
- Sensation of pinprick or minor burning at the time of the bite
- Appearance of small punctures (but sometimes none are visible)
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils and generalized swelling of face and extremities

Brown Recluse: The brown or violin spider is brownish to tan in color, rather flat, and 1/2 to 5/8 inches long. However, unlike the typical species, this spider has been encountered without a violin or “fiddle” shaped mark on the top of the head. Of the brown spider, there are three varieties found in the United States that present a problem to site personnel. These are the brown recluse, the desert violin and the Arizona violin. These spiders may be found in a variety of locations including trees, rocks or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:

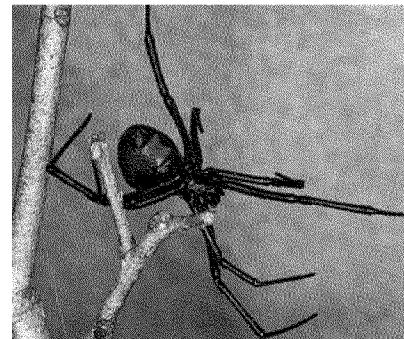
- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite
- Formation of a large, red, swollen, postulating lesion with a bull's-eye appearance
- Systemic affects may include a generalized rash, joint pain, chills, fever, nausea and vomiting
- Pain may become severe after 8 hours, with the onset of tissue necrosis

There is no effective first aid treatment for either of these bites. Except for very young, very old or weak victims, spider bites are not considered to be life threatening. However, medical treatment must be sought to reduce the extent of damage caused by the injected toxins.

Brown Recluse Spider



Black Widow Spider



First aid should include:

- If possible, catch the spider to confirm its identity. Even if the body is crushed, save it for identification
- Clean the bitten area with soap and water or rubbing alcohol
- To relieve pain, place an ice pack over the bite
- Keep the victim quiet and monitor breathing

Seek immediate medical attention

Sensitivity Reaction to Insect Stings or Bites

A sensitivity reaction is one of the more dangerous and acute effects of insect bites or stings. It is the most common cause of fatalities from bites, particularly from bees, wasps, and spiders. Anaphylactic shock due to stings can lead to severe reactions in the circulatory, respiratory, and central nervous system. This can also result in death.

Site personnel must be questioned regarding their allergic reaction to insect bites. Anyone knowingly allergic should be required to carry and know how to use a response kit (e.g., Epi-Kit). First aid providers must be instructed on how to use the kit also. The kit must be inspected to ensure it is updated.

Administer first aid and observe persons reporting stings for signs of allergic reaction, such as unusual swelling, nausea, dizziness, and shock. At the first sign of these symptoms, take the individual to a medical facility for attention.

Insect Borne Diseases

Diseases that are spread by insects include the following: Lyme Disease (tick); Bubonic and other forms of Plague (fleas); Malaria, West Nile Virus and Equine Encephalitis (mosquito).

Tick Borne Diseases

Lyme disease is the second most rapidly spreading disease in the U.S.

Lyme Disease

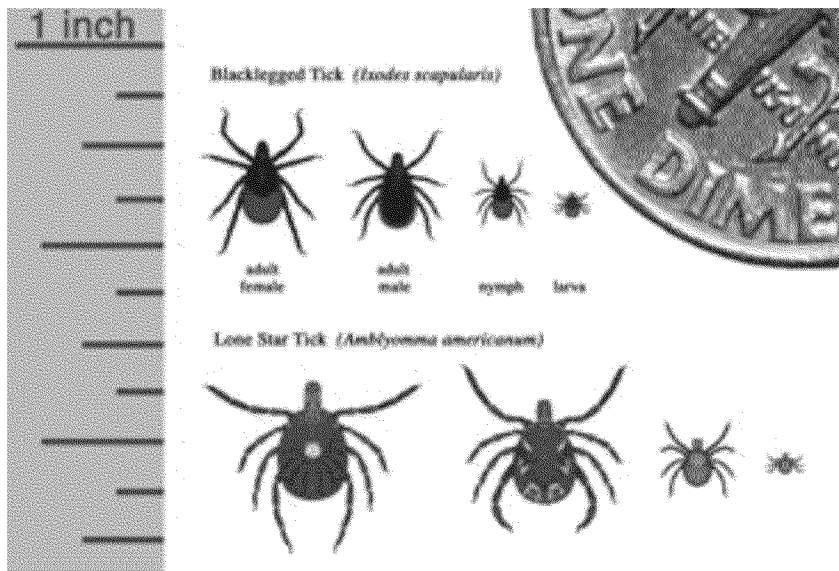
1. Facts

Definition:

- Bacterial infection transmitted by the bite of an infected black-legged tick more popularly known as the deer tick.
- Prevalence (nationwide and other countries).
- Three stages/sizes of deer ticks:
 - Larvae
 - Nymph
 - Adult

Tick season is May through October.

Not all ticks transmit Lyme disease (Black legged or deer tick [upper] compared to the Lone Star tick [lower])



- Ticks must be attached for several hours before Lyme disease can be transmitted.
- Being bitten by a tick does not mean you will get Lyme disease.

2. Prevention and Protection:

- Wear light-colored, tight-knit clothing.
- Wear long pants and long-sleeved shirts.
- Tuck pant legs into shoes or boots.
- Wear a hat.
- Use insect repellent containing DEET ((follow manufacturer's instructions for use).
- Check yourself daily for ticks after being in grassy, wooded areas.
- Request information from the Health and Safety Medical Section regarding Lyme Disease.

3. If Bitten:

- Remove the tick immediately with fine-tipped tweezers. Grasp the tick as close to the skin as possible. Pull gently but firmly without twisting or crushing the tick.
- Wash your hands and dab the bite with an antiseptic.

- Save the tick in a jar in some alcohol. Label the jar with the date of the bite, the area where you picked up the tick and the spot on your body where you were bitten.
- Monitor the bite for any signs of infection or rash.

4. Symptoms:

Early Signs (may vary from person to person)

- Expanding skin rash.
- Flu-like symptoms during summer or early fall that include the following:
 - Chills, fever, headache, swollen lymph nodes.
 - Stiff neck, aching joints, and muscles.
 - Fatigue.
- Later signs
 - Nervous system problems.
 - Heart problems.
 - Arthritis, especially in knees.

5. Upon Onset of Symptoms:

- Notify your Safety Officer (SO) and your supervisor.

Ehrlichiosis

Ehrlichiosis is the general name used to describe several bacterial diseases that affect animals and humans. These diseases are caused by the organisms in the genus *Ehrlichia*. Worldwide, there are currently four ehrlichial species that are known to cause disease in humans.

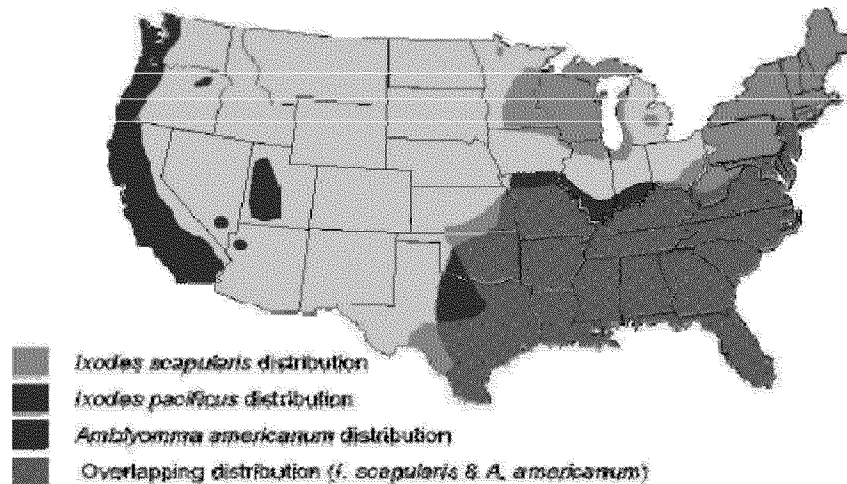
In the United States, ehrlichiae are transmitted by the bite of an infected tick. The lone star tick (*Amblyomma americanum*) and the blacklegged tick (*Ixodes scapularis*) are known vectors of ehrlichiosis.

The symptoms of ehrlichiosis may resemble symptoms of various other infectious and non-infectious diseases. These clinical features generally include fever, headache, fatigue, and muscle aches. Other signs and symptoms may include nausea, vomiting, diarrhea, cough, joint pains, confusion, and occasionally rash. Symptoms typically appear after an incubation period of 5-10 days following the tick bite. It is possible that many individuals who become infected with ehrlichiae do not become ill or they develop only very mild symptoms.

Most cases of ehrlichiosis are reported within the geographic distribution of the vector ticks (see map below). Occasionally, cases are reported from areas outside the distribution of the tick vector. In most instances, these cases have involved persons who traveled to areas where the diseases are endemic, and who had been bitten by an infected tick and developed symptoms after

returning home. Therefore, if you traveled to an ehrlichiosis-endemic area 2 weeks prior to becoming ill, you should tell your doctor where you traveled.

Figure 20. Areas where human ehrlichiosis may occur based on approximate distribution of vector tick species



A diagnosis of ehrlichiosis is based on a combination of clinical signs and symptoms and confirmatory laboratory tests. Blood samples can be sent to a reference laboratory for testing. However, the availability of the different types of laboratory tests varies considerably. Other laboratory findings indicative of ehrlichiosis include low white blood cell count, low platelet count, and elevated liver enzymes.

Ehrlichiosis is treated with a tetracycline antibiotic, usually doxycycline.

Very little is known about immunity to ehrlichial infections. Although it has been proposed that infection with ehrlichiae confers long-term protection against reinfection, there have been occasional reports of laboratory-confirmed reinfection. Short-term protection has been described in animals infected with some *Ehrlichia* species and this protection wanes after about 1 year. Clearly, more studies are needed to determine the extent and duration of protection against reinfection in humans.

Limiting exposure to ticks reduces the likelihood of infection in persons exposed to tick-infested habitats. Prompt careful inspection of your body and removal of crawling or attached ticks is an important method of preventing disease. It may take 24–48 hours of attachment before microorganisms are transmitted from the tick to you.

Preventive measures - Follow protection protocols for Lyme disease

Babesiosis

Babesiosis is an intraerythrocytic parasitic infection caused by protozoa of the genus *Babesia* and transmitted through the bite of the *Ixodes* tick, the same vector responsible for transmission of Lyme disease. While most cases are tick-borne, transfusion and transplacental transmission

have been reported. In the United States, babesiosis is usually an asymptomatic infection in healthy individuals. Several groups of patients become symptomatic, and, within these subpopulations, significant morbidity and mortality occur. The disease most severely affects patients who are elderly, immunocompromised, or asplenic. Among those symptomatically infected, the mortality rate is 10% in the United States.

The primary vectors of the parasite are ticks of the genus *Ixodes*. In the United States, the black-legged tick, *Ixodes scapularis* (also known as *Ixodes dammini*) is the primary vector for the parasite. The *Ixodes* tick vector for *Babesia* is the same vector that locally transmits *Borrelia burgdorferi*, the agent implicated in Lyme disease. The primary US animal reservoir is the white-footed mouse, *Peromyscus leucopus*. Additionally, white-tailed deer serve as transport hosts for the adult tick vector, *I. scapularis*.

The Ixodid ticks ingest *Babesia* during feeding from the host, multiply the protozoa in their gut wall, and concentrate it in their salivary glands. The tick inoculates a new host when feeding again. The parasite then infects red blood cells (RBCs) and differentiated and undifferentiated trophozoites are produced. The former produce 2-4 merozoites that disrupt the RBC and go on to invade other RBCs. This leads to hemolytic anemia, thrombocytopenia, and atypical lymphocyte formation. Alterations in RBC membranes cause decreased conformability and increased red cell adherence, which can lead to development of acute respiratory distress syndrome (ARDS) among those severely affected.

The signs and symptoms mimic malaria and range in severity from asymptomatic to septic shock.

Symptoms include: Generalized weakness, fatigue, depression, fever, anorexia and weight loss, CNS - Headache, photophobia, neck stiffness, altered sensorium, pulmonary - Cough, shortness of breath, GI - Nausea, vomiting, abdominal pain, Musculoskeletal - Arthralgia and myalgia and Renal - Dark urine

Prevention

Prevention measures are the same as for Lyme and other insect borne diseases

Tularemia

Tularemia (also known as "rabbit fever") is a serious infectious disease caused by the bacterium *Francisella tularensis*. The disease is endemic in North America. The primary vectors are ticks and deer flies, but the disease can also be spread through other arthropods. Animals such as rabbits, prairie dogs, hares and muskrats serve as reservoir hosts.

Depending on the site of infection, tularemia has six characteristic clinical syndromes: ulceroglandular, glandular, oropharyngeal, pneumonic, oculoglandular, and typhoidal.

The disease has a very rapid onset, with headache, fatigue, dizziness, muscle pains, loss of appetite and nausea. Face and eyes redden and become inflamed. Inflammation spreads to the

lymph nodes, which enlarge and may suppurate (mimicking bubonic plague). Lymph node involvement is accompanied by a high fever. Death may result.

Francisella tularensis is one of the most infective bacteria known; fewer than ten organisms can cause disease leading to severe illness. The bacteria penetrate into the body through damaged skin and mucous membranes, or through inhalation. Humans are most often infected by tick bite or through handling an infected animal. Ingesting infected water, soil, or food can also cause infection. Tularemia can also be acquired by inhalation; hunters are at a higher risk for this disease because of the potential of inhaling the bacteria during the skinning process. Tularemia is not spread directly from person to person.

No vaccine is available to the general public. The best way to prevent tularemia infection is to wear rubber gloves when handling or skinning rodents or lagomorphs (as rabbits), avoid ingesting uncooked wild game and untreated water sources, and wearing long-sleeved clothes and using an insect repellent to prevent tick bites.

Prevention

No vaccine is available to the general public. The best way to prevent tularemia infection is to wear rubber gloves when handling or skinning rodents or lagomorphs (as rabbits), avoid ingesting uncooked wild game and untreated water sources, and wearing long-sleeved clothes and using an insect repellent to prevent tick bites.

Other diseases primarily transmitted by Arthropods (Ticks, mites, lice etc.)

Typhus (Not to be confused with Typhoid Fever [discussed in these FLDs])

*For the unrelated disease caused by *Salmonella typhi*, see Typhoid fever. For the unrelated disease caused by *Salmonella paratyphi*, please refer to Paratyphoid fever. For the monster of Greek mythology, see Typhus (monster).*

Typhus is any one of several similar diseases caused by louse-borne bacteria. The name comes from the Greek *typhos*, meaning smoky or lazy, describing the state of mind of those affected with typhus. *Rickettsia* is endemic in rodent hosts, including mice and rats, and spreads to humans through mites, fleas and body lice. The arthropod vector flourishes under conditions of poor hygiene, such as those found in prisons or refugee camps, amongst the homeless, or until the middle of the 20th century, in armies in the field. In tropical countries, typhus is often mistaken for dengue fever.

Endemic typhu

Endemic typhus (also called "flea-borne typhus" and "murine typhus" or "rat flea typhus") is caused by the bacteria *Rickettsia typhi*, and is transmitted by the flea that infest rats. Symptoms of endemic typhus include headache, fever, chills, myalgia, nausea, vomiting, and cough.

Endemic typhus is highly treatable with antibiotics. Most people recover fully, but death may occur in the elderly, severely disabled or patients with a depressed immune system.

Encephalitis Arboviral Encephalitides

Perspectives

Arthropod-borne viruses, i.e., arboviruses, are viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods (mosquitoes, psychodids, ceratopogonids, and ticks). Vertebrate infection occurs when the infected arthropod takes a blood meal. The term 'arbovirus' has no taxonomic significance. Arboviruses that cause human encephalitis are members of three virus families: the *Togaviridae* (genus Alphavirus, *Flaviviridae*, and *Bunyaviridae*).

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are "dead-end" hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission (e.g., the virus is transmitted from the female through the eggs to the offspring).

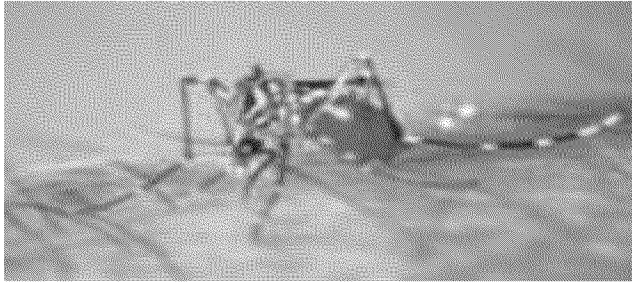
Arboviral encephalitides have a global distribution, but there are four main virus agents of encephalitis in the United States, all of which are transmitted by mosquitoes. A new Powassan-like virus has recently been isolated from deer ticks. Its relatedness to Powassan virus and its ability to cause disease has not been well documented. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In milder (i.e., warmer) parts of the country, where arthropods are active late into the year, cases can occur into the winter months.

There is expanded discussion of several of these diseases (West Nile and Eastern Equine Encephalitis elsewhere in this document. A more general discussion is found in Attachment 2.

Mosquito Borne Diseases

Malaria

Malaria is a mosquito-borne disease caused by a parasite. Four kinds of malaria parasites can infect humans: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*.



People with malaria often experience fever, chills, and flu-like illness. Left untreated, they may develop severe complications and die. Each year 350-500 million cases of malaria occur worldwide. Infection with any of the malaria species can make a person feel very ill; infection with *P. falciparum*, if not promptly treated, may be fatal. Although malaria can be a fatal disease, illness and death from malaria are largely preventable.

This sometimes fatal disease can be prevented and cured. Bed nets, insecticides, and anti-malarial drugs are effective tools to fight malaria in areas where it is transmitted. Travelers to a malaria-risk area should avoid mosquito bites and take a preventive anti-malarial drug. Malaria was eradicated from the United States in the early 1950s. However, malaria is common in many developing countries and travelers who visit these areas risk getting malaria.

Returning travelers and arriving immigrants could also reintroduce the disease in the United States if they are infected with malaria when they return. The mosquito that transmits malaria, *Anopheles*, is found throughout much of the United States. If local mosquitoes bite an infected person, those mosquitoes can, in turn, infect local residents (*introduced malaria*).

Because the malaria parasite is found in red blood cells, malaria can also be transmitted through blood transfusion, organ transplant, or the shared use of needles or syringes contaminated with blood. Malaria may also be transmitted from a mother to her fetus before or during delivery ("congenital" malaria).

Malaria is not transmitted from person to person like a cold or the flu. You cannot get malaria from casual contact with malaria-infected people.

Prevention and control

You can prevent malaria by:

- keeping mosquitoes from biting you, especially at night
- taking anti-malarial drugs to kill the parasites
- eliminating places where mosquitoes breed
- spraying insecticides on walls to kill adult mosquitoes that come inside
- sleeping under bed nets - especially effective if they have been treated with insecticide,
- wearing insect repellent and long-sleeved clothing if out of doors at night

The surest way for you and your health-care provider to know whether you have malaria is to have a diagnostic test where a drop of your blood is examined under the microscope for the presence of malaria parasites. If you are sick and there is any suspicion of malaria (for example, if you have recently traveled in a malaria-risk area) the test should be performed without delay.

The disease should be treated early in its course, before it becomes severe and poses a risk to the patient's life. Several good anti-malarial drugs are available, and should be administered early on. The most important step is to think about malaria, so that the disease is diagnosed and treated in time.

West Nile Virus

West Nile virus (WNV) is a potentially serious illness. Experts believe WNV is established as a seasonal epidemic in North America that flares up in the summer and continues into the fall. This fact sheet contains important information that can help you recognize and prevent WNV.

The easiest and best way to avoid WNV is to prevent mosquito bites.

- When you are outdoors, use insect repellent containing an EPA-registered active ingredient . Follow the directions on the package.
- Many mosquitoes are most active at dusk and dawn. Be sure to use insect repellent and wear long sleeves and pants at these times or consider staying indoors during these hours.
- Make sure you have good screens on your windows and doors to keep mosquitoes out.
- Get rid of mosquito breeding sites by emptying standing water from buckets, barrels and drainage ditches.

About one in 150 people infected with WNV will develop severe illness. The severe symptoms can include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. These symptoms may last several weeks, and neurological effects may be permanent.

Up to 20 percent of the people who become infected have symptoms such as fever, headache, and body aches, nausea, vomiting, and sometimes swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms can last for as short as a few days, though even healthy people have become sick for several weeks.

Approximately 80 percent of people (about 4 out of 5) who are infected with WNV will not show any symptoms at all. Most often, WNV is spread by the bite of an infected mosquito. Mosquitoes become infected when they feed on infected birds. Infected mosquitoes can then spread WNV to humans and other animals when they bite.

In a very small number of cases, WNV also has been spread through blood transfusions, organ transplants, breastfeeding and even during pregnancy from mother to baby.

WNV is not spread through casual contact such as touching or kissing a person with the virus.

Symptoms typically develop between 3 - 14 days after being bitten by an infected mosquito.

There is no specific treatment for WNV infection. In cases with milder symptoms, people experience symptoms such as fever and aches that pass on their own, although even healthy people have become sick for several weeks. In more severe cases, people usually need to go to the hospital where they can receive supportive treatment including intravenous fluids, help with breathing and nursing care.

Milder WNV illness improves on its own, and people do not necessarily need to seek medical attention for this infection though they may choose to do so. If you develop symptoms of severe WNV illness, such as unusually severe headaches or confusion, seek medical attention immediately. Severe WNV illness usually requires hospitalization. Pregnant women and nursing mothers are encouraged to talk to their doctor if they develop symptoms that could be WNV. People over the age of 50 are more likely to develop serious symptoms of WNV if they do get sick and should take special care to avoid mosquito bites.

The more time you're outdoors, the more time you could be bitten by an infected mosquito. Pay attention to avoiding mosquito bites if you spend a lot of time outside, either working or playing.

All donated blood is checked for WNV before being used. The risk of getting WNV through blood transfusions and organ transplants is very small, and should not prevent people who need surgery from having it. If you have concerns, talk to your doctor.

Equine Encephalitis

Eastern equine encephalitis (EEE) is a mosquito-borne viral disease. EEE virus (EEEV) occurs in the eastern half of the United States where it causes disease in humans, horses, and some bird species. Because of the high mortality rate, EEE is regarded as one of the most serious mosquito-borne diseases in the United States.

EEEV is transmitted to humans through the bite of an infected mosquito. It generally takes from 3 to 10 days to develop symptoms of EEE after being bitten by an infected mosquito. The main EEEV transmission cycle is between birds and mosquitoes.

Many species of mosquitoes can become infected with EEEV. The most important mosquito species in maintaining the bird-mosquito transmission cycle is *Culiseta melamurai*, which reproduces in freshwater hardwood swamps. *Culiseta melamurai*, however, is not considered to be an important vector of EEEV to horses or humans because it feeds almost exclusively on birds.

Transmission to horses or humans requires mosquito species capable of creating a “bridge” between infected birds and uninfected mammals such as some *Aedes*, *Coquillettidia*, and *Culex* species.

Horses are susceptible to EEE and some cases are fatal. EEEV infections in horses, however, are not a significant risk factor for human infection because horses are considered to be “dead-end” hosts for the virus (i.e., the amount of EEEV in their bloodstreams is usually insufficient to infect mosquitoes).

Eastern equine encephalitis virus is a member of the family Togaviridae, genus *Alphavirus* closely related to Western equine encephalitis virus and Venezuelan equine encephalitis virus

Many persons infected with EEEV have no apparent illness. In those persons who do develop illness, symptoms range from mild flu-like illness to inflammation of the brain, coma and death.

The mortality rate from EEE is approximately one-third, making it one of the most deadly mosquito-borne diseases in the United States.

There is no specific treatment for EEE; optimal medical care includes hospitalization and supportive care (for example, expert nursing care, respiratory support, prevention of secondary bacterial infections, and physical therapy, depending on the situation).

Approximately half of those persons who survive EEE will have mild to severe permanent neurologic damage.

Incidence rate includes:

- Approximately 220 confirmed cases in the US 1964-2004, Average of 5 cases/year, with a range from 0-15 cases
- States with largest number of cases includes New Jersey.
- EEEV transmission is most common in and around freshwater hardwood swamps in the Atlantic Coast states and the Great Lakes region.

- Human cases occur relatively infrequently, largely because the primary transmission cycle takes place in and around swampy areas where human populations tend to be limited.

Risk Groups:

- Residents of and visitors to endemic areas (areas with an established presence of the virus)
- People who engage in outdoor work and recreational activities in endemic areas.
- Persons over age 50 and younger than age 15 seem to be at greatest risk for developing severe EEE when infected with the virus.

Prevention

- A vaccine is available to protect equines.
- People should avoid mosquito bites by employing personal and workplace protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active (some bridge vectors of EEEV are aggressive day-biters), and removing standing water that can provide mosquito breeding sites.
- There are laboratory tests to diagnosis EEEV infection including serology, especially IgM testing of serum and cerebrospinal fluid (CSF), and neutralizing antibody testing of acute- and convalescent-phase serum.

Meningitis

Meningitis is a viral disease that can affect the central nervous system that is transmitted through the bite from an infected mosquito.

Symptoms can be nonexistent or severe and flu-like, with fever, chills, tiredness, headache, nausea and vomiting. If not treated promptly the disease can be fatal.

Prevention

- A vaccine is available. It's 80% effective after a single dose and 97.5% effective after a second dose.

Use precautions as for other mosquito borne diseases. Avoid mosquito bites by employing personal and workplace protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active and removing standing water that can provide mosquito breeding sites.

Deer Flies (See Tularemia above)

Fleas

Flea is a common name for insects of the order Siphonaptera which are wingless insects with mouthparts adapted for piercing skin and sucking blood. Fleas are external parasites, living by hematophagy off the blood of mammals (including humans). Some species include the cat flea (*Ctenocephalides felis*), dog flea (*Ctenocephalides canis*), and human flea (*Pulex irritans*).

Fleas are small (1.5 to 3.3 mm) long, agile, dark-colored, wingless insect with tube-like mouth parts adapted to feeding on the blood of their hosts. Their legs are long, with the hind pair well adapted for jumping. A flea can jump vertically up to seven inches and horizontally up to 13 inches. The flea body is hard, polished, and covered with many hairs and short spines directed backwards which assists its movement on the host. The body is able to withstand great pressure. Hard squeezing between the fingers is not normally sufficient to kill a flea.

Fleas lay tiny white oval-shaped eggs. The larva is small, pale, has bristles covering its worm-like body, lacks eyes, and has mouthparts adapted to chewing.

Fleas can cause medical problems include flea allergy dermatitis, secondary skin irritations and, in extreme cases, anemia, tapeworms, and stomach flu. Fleas can transmit murine typhus (endemic typhus) fever among animals and from animal to humans. Fleas can also transmit bubonic plague. Tapeworms normally infest in human severe cases. Although the bite is rarely felt, it is the resulting irritation caused by the flea salivary secretions that varies among individuals. Some result in a severe reaction including a general rash or inflammation resulting in secondary infections caused by scratching the irritated skin. Most bites are found on the feet and legs with the formation of small, hard, red, slightly raised itching spots with a single puncture point in the center of each spot.

Treatment

Flea bites can be treated with anti-itch creams, usually antihistamines or hydrocortisone.

Bed Bugs

Bed bugs are small parasitic insects that feed on human blood. A number of health effects may occur due to bed bugs including skin rashes, prominent blisters, psychological effects and allergic symptoms. Diagnosis involves finding the bed bugs and the occurrence of compatible symptoms. Treatment is otherwise symptomatic.

Adult bed bugs are reddish-brown, flattened, oval and wingless. Bed bugs have microscopic hairs that give them a banded appearance. Adults grow to 4-5mm in length and 1.5-3 mm wide. A bed bug pierces the skin of its host with two hollow feeding tubes shaped like tongues. The one tube injects its saliva, which contains anticoagulants and anesthetics, while the other draws blood of its host. After feeding for approximately five minutes, the bug returns to its hiding place. Although bed bugs can live for a year without feeding, they normally feed every five to ten days.

Eradication of bed bugs frequently requires a combination of pesticide and non-pesticide approaches. Pyrethroids, dichlorvos, and malathion have historically been effective. Mechanical approaches include vacuuming and heat treating or wrapping mattresses have also been recommended.

ATTACHMENT 1
RICKETTSIAL INFECTIONS

Rickettsial Infections

Description

Many species of *Rickettsia* can cause illnesses in humans (Table below). The term “rickettsiae” conventionally embraces a polyphyletic group of microorganisms in the class Proteobacteria, comprising species belonging to the genera *Rickettsia*, *Ehrlichia*, *Coxiella*, and *Bartonella*. These agents are usually not transmissible directly from person to person except by blood transfusion or organ transplantation, although sexual and placental transmission has been proposed for *Coxiella*. Transmission generally occurs via an infected arthropod vector or through exposure to an infected animal reservoir host. However, sennetsu fever is acquired following consumption of raw fish products. The clinical severity and duration of illnesses associated with different rickettsial infections vary considerably, even within a given antigenic group. Rickettsioses range in severity from diseases that are usually relatively mild (cat scratch disease) to those that can be life-threatening (murine typhus) and they vary in duration from those that can be self-limiting to chronic (Q fever and bartonellosis) or recrudescent (Brill-Zinsser disease). Most patients with rickettsial infections recover with timely use of appropriate antibiotic therapy.

Travelers may be at risk for exposure to agents of rickettsial diseases if they engage in occupational or recreational activities which bring them into contact with habitats that support the vectors or animal reservoir species associated with these pathogens.

The geographic distribution and the risks for exposure to rickettsial agents are described below and in the Table below.

Trench Fever

Trench fever, which is caused by *Bartonella quintana*, is transmitted from one person to another by the human body louse. Contemporary outbreaks of both diseases are rare in most developed countries and generally occur only in communities and populations in which body louse infestations are frequent, especially during the colder months when louse-infested clothing is not laundered. Foci of trench fever have also been recognized among homeless populations in urban centers of industrialized countries. Travelers who are not at risk of exposure to body lice or to persons with lice are unlikely to acquire these illnesses. However, health-care workers who care for these patients may be at risk for acquiring louse-borne illnesses through inhalation or inoculation of infectious louse feces into the skin or conjunctiva.

Murine Typhus

Murine typhus, which is caused by infection with *Rickettsia typhi*, is transmitted to humans by rat fleas, particularly during exposure in rat-infested buildings (3). Flea-infested rats can be found throughout the year in humid tropical environments, especially in harbor or riverine environments. In temperate regions, they are most common during the warm summer months.

Travelers who participate in outdoor activities in grassy or wooded areas (e.g., trekking, camping, or going on safari) may be at risk for acquiring tick-borne illnesses, including those caused by *Rickettsia*, and *Ehrlichia* species (see below).

TABLE Epidemiologic features and symptoms of rickettsial diseases

ANTIGENIC GROUP	DISEASE	AGENT	PREDOMINANT SYMPTOMS*	VECTOR OR ACQUISITION MECHANISM	ANIMAL RESERVOIR	GEOGRAPHIC DISTRIBUTION OUTSIDE THE US
Typhus fevers	Murine typhus	<i>R. typhi</i>	As above, generally less severe	Rat flea	Rats, mice	Worldwide
Spotted fevers						
Coxiella	Q fever	<i>Coxiella burnetii</i>	Fever, headache, chills, sweating, pneumonia, hepatitis, endocarditis	Most human infections are acquired by inhalation of infectious aerosols; tick	Goats, sheep, cattle, domestic cats, other	Worldwide
Bartonella	Cat-scratch disease	<i>Bartonella henselae</i>	Fever, adenopathy, neuroretinitis, encephalitis	Cat flea	Domestic cats	Worldwide
	Trench fever	<i>B. quintana</i>	Fever, headache, pain in shins, splenomegaly, disseminated rash	Human body louse	Humans	Worldwide
Ehrlichia	Ehrlichiosis	<i>Ehrlichia chaffeensis</i> [#]	Fever, headache, nausea, occasionally rash	Tick	Various large and small mammals, including deer and rodents	Worldwide

This represents only a partial list of symptoms. Patients may have different symptoms or only a few of those listed.

Anaplasmosis and Ehrlichiosis

Human ehrlichiosis and anaplasmosis are acute tick-borne diseases, associated with the lone star tick, *Amblyomma americanum*, and *Ixodes* ticks, respectively. Because one tick may be infected with more than one tick-borne pathogen (e.g. *Borrelia burgdorferi*, the causative agent of Lyme disease, or various *Babesia* species, agent of human babesiosis), patients may be present with

atypical clinical symptoms that complicate treatment. Ehrlichioses and anaplasmosis are characterized by infection of different types of leukocytes, where the causative agent multiplies in cytoplasmic membrane-bound vacuole called morulae. Morulae can sometimes be detected in Giemsa-stained blood smears.

Q FEVER

Q fever occurs worldwide, most often in persons who have contact with infected goat, sheep, cat and cattle, particularly parturient animals (especially farmers, veterinarians, butchers, meat packers, and seasonal workers). Travelers who visit farms or rural communities can be exposed to *Coxiella burnetii*, the agent of Q fever, through airborne transmission (via animal-contaminated soil and dust) or less commonly through consumption of unpasteurized milk products or by exposure to infected ticks. These infections may initially result in only mild and self-limiting influenza-like illnesses, but if untreated, infections may become chronic, particularly in persons with preexisting heart valve abnormalities or with prosthetic valves. Such persons can develop chronic and potentially fatal endocarditis.

Cat-Scratch Disease

Cat-scratch disease is contracted through scratches and bites from domestic cats, particularly kittens, infected with *Bartonella henselae*, and possibly from their fleas (3, 4). Exposure can therefore occur wherever cats are found.

Symptoms

Clinical presentations of rickettsial illnesses vary (Table above), but common early symptoms, including fever, headache, and malaise, are generally nonspecific. Illnesses resulting from infection with rickettsial agents may go unrecognized or are attributed to other causes. Atypical presentations are common and may be expected with poorly characterized non-indigenous agents, so appropriate samples for examination by specialized reference laboratories should be obtained. A diagnosis of rickettsial diseases is based on two or more of the following: 1) clinical symptoms and an epidemiologic history compatible with a rickettsial disease, 2) the development of specific convalescent-phase antibodies reactive with a given pathogen or antigenic group, 3) a positive polymerase chain reaction test result, 4) specific immunohistologic detection of rickettsial agent, or 5) isolation of a rickettsial agent. Ascertaining the likely place and the nature of potential exposures is particularly helpful for accurate diagnostic testing.

Prevention

With the exception of the louse-borne diseases described above, for which contact with infectious arthropod feces is the primary mode of transmission (through autoinoculation into a wound, conjunctiva, or inhalation), travelers and health-care providers are generally not at risk for becoming infected via exposure to an ill person. Limiting exposures to vectors or animal reservoirs remains the best means for reducing the risk for disease. Travelers and persons working in areas where organisms may be present should implement prevention based on avoidance of vector-infested habitats, use of repellents and protective clothing, prompt detection and removal of arthropods from clothing and skin, and attention to hygiene.

Q fever and *Bartonella* group diseases may pose a special risk for persons with abnormal or prosthetic heart valves, and *Rickettsia*, *Ehrlichia*, and *Bartonella* for persons who are immunocompromised.

ATTACHMENT 2

ENCEPHALITIS ARBOVIRAL ENCEPHALITIDES

Encephalitis Arboviral Encephalitides

Perspectives

Arthropod-borne viruses, i.e., arboviruses, are viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods (mosquitoes, psychodids, ceratopogonids, and ticks). Vertebrate infection occurs when the infected arthropod takes a blood meal. The term 'arbovirus' has no taxonomic significance. Arboviruses that cause human encephalitis are members of three virus families: the *Togaviridae* (genus *Alphavirus*, *Flaviviridae*, and *Bunyaviridae*).

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are "dead-end" hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission (e.g., the virus is transmitted from the female through the eggs to the offspring).

Arboviral encephalitides have a global distribution which is transmitted by mosquitoes. Powassan, is a minor cause of encephalitis in the northern United States, and is transmitted by ticks. A new Powassan-like virus has recently been isolated from deer ticks. Its relatedness to Powassan virus and its ability to cause disease has not been well documented. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In milder (i.e., warmer) parts of the country, where arthropods are active late into the year, cases can occur into the winter months.

The majority of human infections is asymptomatic or may result in a nonspecific flu-like syndrome. Onset may be insidious or sudden with fever, headache, myalgias, malaise and occasionally prostration. Infection may, however, lead to encephalitis, with a fatal outcome or permanent neurologic sequelae. Fortunately, only a small proportion of infected persons progress to frank encephalitis.

Experimental studies have shown that invasion of the central nervous system (CNS), generally follows initial virus replication in various peripheral sites and a period of viremia. Viral transfer from the blood to the CNS through the olfactory tract has been suggested. Because the arboviral encephalitides are viral diseases, antibiotics are not effective for treatment and no effective antiviral drugs have yet been discovered.

Prevention

Arboviral encephalitis can be prevented in two major ways: personal protective measures and public health measures to reduce the population of infected mosquitoes. Personal measures include reducing time outdoors particularly in early evening hours, wearing long pants and long sleeved shirts and applying mosquito repellent to exposed skin areas. Public health measures often require spraying of insecticides to kill juvenile (larvae) and adult mosquitoes.

Selection of mosquito control methods depends on what needs to be achieved; but, in most emergency situations, the preferred method to achieve maximum results over a wide area is aerial spraying. In many states aerial spraying may be available in certain locations as a means to control nuisance mosquitoes. Such resources can be redirected to areas of virus activity. When aerial spraying is not routinely used, such services are usually contracted for a given time period. Financing of aerial spraying costs during large outbreaks is usually provided by state emergency contingency funds. Federal funding of emergency spraying is rare and almost always requires a federal disaster declaration. Such disaster declarations usually occur when the vector-borne disease has the potential to infect large numbers of people, when a large population is at risk and when the area requiring treatment is extensive. Special large planes maintained by the United States Air Force can be called upon to deliver the insecticide(s) chosen for such emergencies. Federal disaster declarations have relied heavily on risk assessment by the CDC.

There are no commercially available human vaccines for these U.S. diseases.

Powassan Encephalitis

Powassan (POW) virus is a flavivirus and currently the only well documented tick-borne transmitted arbovirus occurring in the United States and Canada. Recently a Powassan-like virus was isolated from the deer tick, *Ixodes scapularis*. Its relationship to POW and its ability to cause human disease has not been fully elucidated. POW's range in the United States is primarily in the upper tier States. In addition to isolations from man, the virus has been recovered from ticks (*Ixodes marxi*, *I. cookei* and *Dermacentor andersoni*) and from the tissues of a skunk (*Spilogale putorius*). It is a rare cause of acute viral encephalitis. POW virus was first isolated from the brain of a 5-year-old child who died in Ontario in 1958. Patients who recover may have residual neurological problems.

Other Arboviral Encephalitides

Many other arboviral encephalitides occur throughout the world. Most of these diseases are problems only for those individuals traveling to countries where the viruses are endemic.

West Nile Encephalitis

Discussed elsewhere in this document

FLD 43 D HAZARDOUS PLANTS

A number of hazardous plants may be encountered during field operations. The ailments associated with these plants range from mild hay fever to contact dermatitis. Plants that present the greatest risk to site workers are those that produce allergic reactions and tissue injury.

Plants That Cause Skin and Tissue Injury

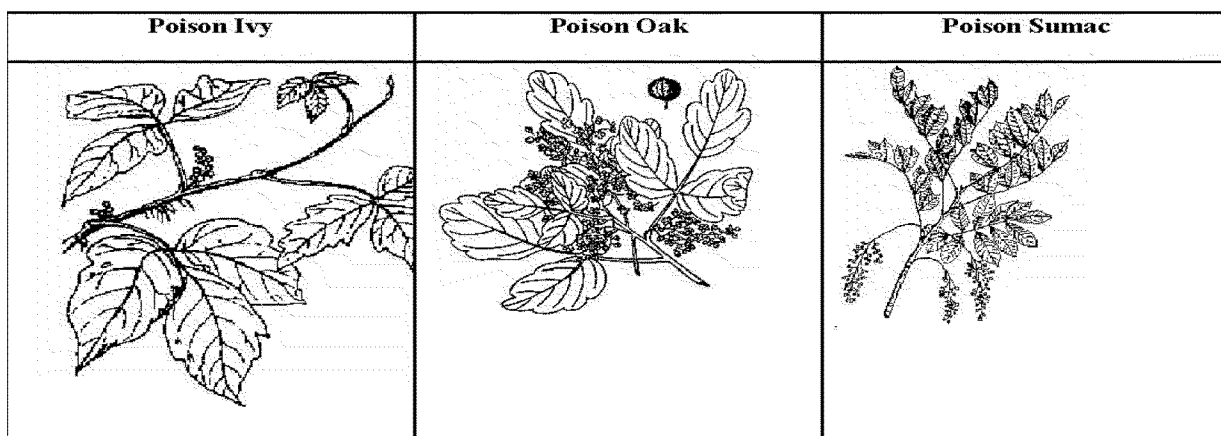
Contact with sharp leaves and thorns are of special concern to site personnel. This concern stems from the fact that punctures, cuts, and even minor scrapes caused by accidental contact may result in skin lesions and the introduction of fungi or bacteria through the skin. This is especially important in light of the fact that the warm moist environment created inside protective clothing is ideal for the propagation of fungal and bacterial infection. Personnel receiving any of the injuries listed above, even minor scrapes shall report immediately for continued observation and care. Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

Plants That Cause an Allergic Reaction

The poisonous plants of greatest concern are poison ivy, poison oak, and poison sumac. Contact with the poisonous sap of these plants produces a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim also may develop a high fever and may be very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each. In certain seasons, both plants also have greenish-white flowers and berries that grow in clusters. Poison sumac is a tall shrub or small tree with 6 to 12 leaflets arranged in pairs with a single leaflet at the end. This plant grows in wooded, swampy areas.

Poison Ivy/Poison Oak/Poison Sumac



The reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact
- Reddening, swelling, itching and burning at the site of contact
- Pain, if the reaction is severe
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin

If the rash is scratched, secondary infections can occur. Preventive measures that are effective for most site personnel include:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify, report and mark poisonous plants found on site
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment and clothing
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution

Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

Plants That are Poisonous

There are a number of plants worldwide beside poison ivy, oak and sumac which have poisonous properties. In many cases consumption of these plants or parts of these plants can result in poisoning. In other cases, contact with the plants may be poisonous. The following is a listing with pertinent information on poisonous properties and locations of a number of plants.

In general, when working in the outdoors or where you may come in contact with household plants or where your families may come in contact with these plants, it is important that as soon as possible after contact the area or areas should be thoroughly washed and hands must be thoroughly washed before eating drinking, smoking or any other hand to mouth contact.

In keeping with our 24/7 BBS concept, it is important to remember that children are particularly vulnerable to many of the poisonous parts of these plants. Many of these poisonous parts resemble non-poisonous food items such as berries and are attractive.

As with most lists there is extensive information but the list may not include all poisonous plants.

It is important to remember that this document is a starting point to be supplemented with local information. The majority of this information is from a list found in Wikipedia an on line Dictionary readily accessible via Google. The website has pictures of these plants as well as links to other information sources.

POISONOUS PLANTS

From Wikipedia,

This is a list of plants containing poisonous parts that pose a serious risk of illness, injury, or death to humans.

Poisonous Food Plants

- Apple (*Malus domestica*) **Found worldwide in cooler climates.** Seeds contain cyanogenic glycosides; although the amount found in most apples won't kill a person.
- Cherry (*Prunus cerasus*), as well as other species (*Prunus spp*) such as peach (*Prunus persica*), plum (*Prunus domestica*), almond (*Prunus dulcis*) and apricot (*Prunus armeninaca*). **There are around 430 species of *Prunus*, spread throughout the northern temperate regions of the globe.** Leaves and seeds contain cyanogenic glycosides
- Rhubarb (*Rheum rhaponticum*) **Found worldwide.** Leaves, but not stems, contain oxalic acid salts, causing kidney disorders, convulsions, and coma. Rarely fatal.
- Tomato (*Solanum lycopersicum*) **Found worldwide.** Foliage and vines contain alkaloid poisons which cause digestive upset and nervous excitement.

Other Poisonous Plants

- Autumn crocus. **Found in North America.** The bulbs are poisonous and cause nausea, vomiting, diarrhea. **Can be fatal.**
- Azalea **Found Worldwide.** All parts of the plant are poisonous and cause nausea, vomiting, depression, breathing difficulties, and coma. Rarely fatal.
- Bittersweet nightshade **Naturalized in North America.** All parts are poisonous, containing solanine and causing fatigue, paralysis, convulsions and diarrhea. Rarely fatal.
- Bleeding heart / Dutchman's breeches. **Found in North America.** Leaves and roots are poisonous and cause convulsions and other nervous symptoms.
- Black locust. **Naturalized in North America.** Pods are toxic
- Caladium / Elephant ear. **Ornamental plants in North America.** All parts of the plant are poisonous. Symptoms are generally irritation, pain, and swelling of tissues. If the mouth or tongue swells, breathing may be fatally blocked.

- Castor Oil Plant (*Ricinus communis*) Castor Oil Plant. **Found Worldwide.** The phytotoxin is **ricin**, an extremely toxic water soluble protein, which is concentrated in the seed. Also present are ricinine, an alkaloid, and an irritant oil. Causes burning in mouth and throat, convulsions, and is **often fatal**.
- Daffodil. **Found worldwide.** The bulbs are poisonous and cause nausea, vomiting, and diarrhea. **Can be fatal.**
- Daphne (*Daphne sp.*) **Ornamental plant worldwide.** The berries (either red or yellow) are poisonous, causing burns to mouth and digestive tract, followed by coma. **Often fatal.**
- Darnel/Poison Ryegrass (*Lolium temulentum*) **Usually grows in the same production zones as wheat and is considered a weed.** The seeds and seed heads of this common garden weed may contain the alkaloids temuline and loliine. Some experts also point to the fungus ergot or fungi of the genus endoconidium both of which grow on the seed heads of rye grasses as an additional source of toxicity.
- Deadly nightshade (*Atropa belladonna*) **Naturalized in parts of North America.** All parts of the plant contain the toxic alkaloid atropine. The young plants and seeds are especially poisonous, causing nausea, muscle twitches, paralysis; **often fatal**.
- Dumbcane / dieffenbachia. **Found in tropical areas and popular as house plants.** All parts are poisonous, causing intense burning, irritation, and immobility of the tongue, mouth, and throat. Swelling can be severe enough to block breathing leading to death.
- Ivy. **Native to North America** where winters are not severe. The leaves and berries are poisonous, causing stomach pains, labored breathing, possible coma.
- Jerusalem cherry **United States** All parts, especially the berries, are poisonous, causing nausea and vomiting. **Looks like a cherry tomato.** It is occasionally fatal, especially to children.
- Lilies **Worldwide** There are some 3500 species that comprise the lily (Lilaceae) family. Some are beneficial including (foods such as onion, shallot, garlic, chives [all *Allium* spp] and asparagus) and some with medicinal uses (colchicine and red squill) Many produce alkalids which are poisonous, especially to cats.
- Manchineel (*Hippomane mancinella*) **Native to the Caribbean (including Puerto Rico and the Virgin Islands).** It is one of the most poisonous trees in the world All parts of this tree including the fruit contain toxic phorbol esters typical of the Euphorbiaceae. Sap may cause burning of the skin and smoke from burning may cause eye irritation and blindness. Fruits, which are similar in appearance to an apple, are green or greenish-yellow when ripe.
- Oak Worldwide Most species foliage and acorns are mildly poisonous, causing digestive upset, heart trouble, contact dermatitis. Rarely fatal.

- Poison-ivy (*Toxicodendron radicans*), Poison-oak (*T. diversilobum*), and Poison Sumac (*T. vernix*) **North America** All parts of these plants contain a highly irritating oil with urushiol (this is actually not a poison but an allergen). Skin reactions can include blisters and rashes. It spreads readily to clothes and back again, and has a very long life. Infections can follow scratching.
- Pokeweed (*Phytolacca sp.*) **Native to North America.** Leaves, berries and roots contain phytolaccatoxin and phytolaccigenin - toxin in young leaves is reduced with each boiling and draining.

FLD 49 SAFE STORAGE OF SAMPLES

REFERENCE

DOT Emergency Response Guide (ERG)

To ensure that multi-media samples collected in the course of WESTON work assignments are not stored in a manner that creates undue hazard to WESTON employees or others.

PROCEDURE

Samples that are transported from a WESTON work location must be classified and packaged in compliance with U.S. Department of Transportation (DOT) regulations or alternatively in accordance with International Air Transport Association (IATA) regulations. WESTON's manual of Procedures for Shipping and Transporting Dangerous Goods must be consulted to determine if the samples will be classified as either "environmental" or "hazardous materials" samples.

Environmental Samples

Environmental samples are not subject to DOT or IATA dangerous goods regulations and must be packaged to protect their integrity during transportation and temporary storage and should have appropriate chain-of-custody documentation. These samples may be brought to a WESTON office location or rented space to verify sample documentation and repackaging (e.g., with ice or cold packs). Minor spill clean-up capability is required.

Once secured for shipment, these samples can be temporarily stored for the next day ground or air shipment pick-up. Under no circumstances are samples to be stored beyond the time necessary to arrange for transportation to a laboratory.

Hazardous Materials Samples

These samples are subject to DOT and/or IATA dangerous goods regulations and must be packaged and labeled according to the appropriate regulations, including completed chain-of-custody documentation prior to being transported from the WESTON work site. WESTON drivers must have the documentation for the samples and a DOT Emergency Response Guide (ERG) readily available in the vehicle. The ERG is available on-line at: <http://hazmat.dot.gov/pubs/erg/gydebook.htm> and appropriate sections can be copied to accompany samples being transported by vehicles driven by WESTON employees.

Under normal circumstances these samples should be shipped from the field and never brought back to a WESTON office location or into a rented space. If it is not possible to ship the samples from the field during the same day they are collected, a properly packaged, labeled, and sealed sample shipping container may be brought back to a WESTON office location for shipment to a laboratory the next business day - provided the temporary storage location is secure from access by any personnel who are not trained in shipping hazardous materials. Under no circumstances are samples to be stored in rented space; if necessary, secure temporary storage in a locked vehicle may be authorized. Note that some office leases do not permit the storage of hazardous materials and the lease will govern whether such materials can be stored overnight.

INSPECTION FOLLOW-UP

Shipping procedures for samples should be included in the site-specific health and safety plan (HASP) and reviewed for compliance with these procedures prior to approval. EHS audits will include a review to sample shipping and storage procedures.

FLD 56 DRILLING SAFETY

REFERENCES

WESTON Corporate Environmental, Health, and Safety Program
Environmental Remediation Drilling Safety Guideline (AntiEntropics, Inc., 2005)

RELATED FLDs

FLD02 – Inclement Weather
FLD03 – Hot Processes
FLD10 – Manual Lifting and Handling of Heavy Objects
FLD11 – Rough Terrain
FLD12 – Housekeeping
FLD20 – Traffic
FLD22 – Heavy Equipment Operation
FLD30 – Hazardous Materials Use and Storage
FLD31 – Fire Prevention and Protection Planning
FLD32 – Fire Extinguishers Required and Requirements
FLD34 – Utilities
FLD35 – Electrical Safety
FLD38 – Hand and Power Hand Tools
FLD47 – Clearing, Grubbing, and Logging Operations
FLD57 – Motor Vehicle Safety

INTRODUCTION

Safety is critical when working on or around a drill rig, traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tools.

As allowed by copyright, WESTON has adopted the *Environmental Remediation Drilling Safety Guideline* (ERD Safety Guideline) for use on drilling projects. The ERD Safety Guideline addresses environmental remediation drilling and push-probe safety and is an account of work for a collective of environmental remediation industry parties. As stated in the copyright notice for the ERD Safety Guideline, “the authors of this guidance are not undertaking to meet the duties of employers, manufacturers, or suppliers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local, state, or federal laws.” Additionally, “the owner of the copyright hereby grants a nonexclusive, royalty-free license to reproduce and distribute this guide subject to the following limitations:

- Y The document must be reproduced in its entirety without alterations.
- Y All copies of this document must include a cover page bearing the copyright notice and this notice.
- Y Copies of this document may not be sold.

WESTON personnel will use the ERD Safety Guideline in compliance with the copyright notice.

This FLD provides a bridge from Weston's Corporate Environmental, Health, and Safety (EHS) Program to the related processes and forms to be used, and to ERD Safety Guideline information to be implemented, as applicable.

Safety during Start-up and Drilling Operations

The WESTON project manager (PM) and safety personnel are responsible for determining the appropriate procedures to be followed to ensure drilling work is performed safely and must review local, state, and federal laws and regulations that are applicable to each project. If required, client drilling guidelines and/or procedures will be implemented.

Prior to drilling, the PM and field safety officer (FSO) ensure that a site-specific health and safety plan (HASP) and activity hazards analyses have been developed in accordance with Weston's EHS Program. Drill rigs must be operated safely in accordance with manufacturer's operating procedures. General safety information is provided in the ERD Safety Guideline. A Pre-Mobilization Checklist is provided as Attachment 1 and a Drill Rig Inspection Checklists is provided as Attachment 2. Additionally, a Borehole Clearance Review checklist (specifically required on ConocoPhillips projects – other clients may have differing requirements) is provided as Attachment 3 and may be modified for use on other projects.

The FSO observes drilling start-up and operations to ensure adherence to safety requirements. The operator must not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. The drill rig and tools must be used only for the purposes for which they are intended and designed.

Utilities

Safety requirements established in FLD 34 *Utilities* and FLD 35 *Electrical Safety* must be observed during drilling operations. Additional utility safety information specific to drilling activities is provided in the ERD Safety Guideline.

Field Safety Officer

Every drill crew should have a designated FSO (in most cases - the drill rig operator). The FSO has the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to listen to the safety directions of the FSO. The FSO's general responsibilities are established in the EHS Program. Responsibilities specific to drilling include:

- Y The FSO should understand and communicate that proper maintenance of tools and equipment and general "housekeeping" on the drill rig will provide the environment to promote and ensure safety.
- Y Before drilling activities begin, the FSO must ensure that the operator (who may be the safety supervisor) has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.
- Y The FSO should inspect the drill rig daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and or damaged pressure gauges and pressure relief valves.
- Y The FSO should check and test all safety devices, such as emergency shutdown switches, at least daily and preferably at the start of a drilling shift. Drilling should not be permitted until all emergency shutdown and warning systems are working correctly.
- Y The FSO should ensure that emergency devices are not wire-grounded, bypassed, or removed.

- Y The FSO should check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds on each starting of an engine.
- Y The FSO should ensure that all new drill rig workers are informed of safe operating practices on and around the drill rig and should provide each new drill rig worker with a copy of the ERD Safety Guideline or the client's drilling operations safety manual, and, when appropriate, the drill rig manufacturer's operations and maintenance manual. The FSO should ensure that each new employee reads and understands the safety and operations and maintenance manuals.
- Y The FSO should carefully instruct a crew worker in drilling safety and observe the new worker's progress towards understanding safe operating practices.
- Y The FSO should ensure that there is a first-aid kit, blood borne pathogen kit, and a fire extinguisher on each drill rig and on each additional vehicle, and ensure that they are properly maintained.
- Y The FSO (and as many crew members as possible) should be well trained and capable of using first-aid kits, fire extinguisher, and all other safety devices and equipment.

Personal Protective Equipment

For most drilling projects, personal protective equipment (PPE) should include a safety hard hat, safety shoes, safety glasses, and close fitting but comfortable clothes, without loose ends, straps, draw strings, belts, or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry should not be worn during a work shift.

For some drilling operations, the environment or regulations may dictate that other PPE be used. The design and composition of the PPE must be determined jointly by the management of the drilling organization and the FSO. Such equipment might include face or ear protection or reflective clothing. Each drill rig worker should wear noise reducing ear protectors when appropriate. When drilling is performed in chemically-or radiological contaminated ground, special protective equipment and clothing may be required. Additional information regarding PPE is provided in the WESTON PPE Program and in the ERD Safety Guideline. The client may have specific requirements concerning PPE. This must be addressed prior to any work and included in the HASP.

Housekeeping and Drill Rig Maintenance

It is critical for safe field operations that the safety supervisor understands and fulfills the responsibility for maintenance and housekeeping on and around the drill rig. General housekeeping requirements are established in FLD 12 and housekeeping inspection forms are available on the EHS Portal site. Housekeeping and maintenance recommendations specific to drilling rigs are also provided in the ERD Safety Guideline.

Drill rig maintenance must be performed in accordance with manufacturer's recommendations. Safety requirements established in FLD 57 must be observed during vehicle maintenance.

Safe Use of Hand Tools

Numerous and various hand tools can be used on or around a drill rig and in repair shops. "Use the tool for its intended purpose" is the most important rule of proper use. Safety requirements established in FLD 38 must be observed for the specific tools to be used on and around drill rigs.

Clearing the Work Area

Prior to drilling, adequate site clearing and leveling should be performed in accordance with FLD 47 *Clearing, Grubbing, and Logging Operations* to provide a safe working area for the drill rig and supplies. Additional information related to clearing and leveling is provided in the ERD Safety Guideline. See also the Borehole Clearance Guidance attached.

Safe Use of Electricity

Drilling projects sometimes require around-the-clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFPA 70-2005 or most current edition) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B). Lights should be installed and positioned to ensure that the work area and operating positions are well lit without shadows or blind spots. The electrical safety requirements established in FLD 35 must be observed during land-based drilling operations. Additional electrical safety information is provided in the ERD Safety Guideline.

Safe Use of Wire Line Hoists, Wire Rope, Catheads and Hoists

The ERD Safety Guideline provides information on wire rope, catheads, and hoisting safety.

Safe Use of Augers and Rotary and Core Drilling Tools

The FSO must ensure that safety precautions and procedures are followed when starting a boring with continuous flight or hollow-stem augers. The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.

The operator ensures that special precautions are taken for safe rotary or core drilling involve chucking, joint break, hoisting, and lowering of drill rods. The ERD Safety Guideline provides comprehensive safety information for these operations.

Safety during Travel

The individual who transports a drill rig on and off a drilling site must observe traffic safety requirements established in FLD 20 *Traffic* and guidelines specific to drill rigs provided in the ERD Safety Guideline.

Loading and Unloading

Safety requirements established in FLD 57 for loading and unloading vehicles or other items on a trailer or truck must be observed. Guidelines specific to loading and unloading drill rigs are provided in the ERD Safety Guideline.

Off-Road Movement

The safety requirements related to off-road movement established in FLD 11 should be observed. Guidelines specific to off-road movement of drill rigs are provided in the ERD Safety Guideline.

Tires, Batteries and Fuel

Tires, batteries, and fuel must be inspected or checked in accordance with FLD 57.

First Aid

A first aid kit should be available and well maintained on each drill site. At least one or more members of each drill crew should be trained to perform first aid. Weston's EHSTrack is used to track and identify personnel first aid training. Training should be provided or sponsored by the American Red Cross or a similar organization. For drilling operations, it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin.

Drill Rig Alterations

Alterations to a drill rig or drilling tools should only be made by qualified personnel and only after consultation with the manufacturer. Drill rigs must be inspected after any alterations prior to release for drilling activities. The Drill Rig Inspection Checklist is available on-line on the WESTON EHS Portal Site or through any WESTON safety officer or EHS representative.

ATTACHMENT 1 PRE-MOBILIZATION CHECKLIST

(Adopted from ERD Safety Guideline Attachment 3.A)

Check When Completed	Checklist of Items
	Participate in boring, utility, locate and walk site
	Verify equipment needs and equipment staging area(s)
	Verify sequence of onsite mobilizations
	Service brakes, including trailer brake connections
	Service Parking (hand) brake
	Service Steering mechanism.
	Service Lighting devices and reflectors
	Service Tires
	Service Horn
	Service Windshield wiper or wipers
	Service Rear-vision mirror or mirrors.
	Service Coupling devices
	Inspect the windshield for cracks, repair or replace as necessary
	Verify that an appropriate, permitted fire extinguisher is within the driver's grasp and that the extinguisher is properly secured.
	Verify supply of sufficient flares or reflectors which can be used in the event of a breakdown while on the highway.
	Verify that seat belts are in good working condition.
	Verify all windows function properly. Repair or replace as necessary
	Verify all doors lock and function properly. Repair or replace as necessary.
	Verify back-up alarms are installed and function properly. Repair/replace as necessary.
	Verify that all lug nuts are properly tightened and that the wheels appear to be in good condition, the spare tire is in good condition, properly inflated, and a suitable jack and lug wrench are available.
	Verify the mast, jacks, deck (s), and tools are completely secured prior to moving the vehicle.
	Verify all tool boxes are closed and properly secured.
	Inspect all spools containing wire rope (cable) and verify they are secured and that the cables will not unwind while driving down the road.

ATTACHMENT 2
DRILL/DIRECT PUSH TYPE RIG INSPECTION CHECKLIST
(Adapted from the ERD Safety Guideline - Attachment 4.B)

SITE/PROJECT NAME: _____	
RIG INSPECTOR (NAME/CO.): _____	
RIG INFORMATION:	
Rig Type: Rotary/Auger	Drilling Rig <input type="checkbox"/> Direct Push Type (DPT) <input type="checkbox"/>
Owner: _____	
Yr/Make: _____	
Model: _____	
VIN #: _____	
Mileage: _____	
Drill Hrs: _____	

INSPECTOR TO INITIAL COLUMNS BELOW AS APPROPRIATE

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
Emergency Switches	Kill switches are located and accessible to workers on both sides of the rotating stem. NOTE: Location and number of switches depend on the rig manufacturer, please refer to owner's manual (DPT typically has one switch on control panel).				
	Kill switches installed by the manufacturer are verified to be in operable condition and all workers are familiar with the location and operation of these switches. NEVER BYPASS, DISABLE, OR REMOVE KILL DEVICES.				
Protective Guards	Drive shafts, belts, chain drives, and universal joints are guarded to prevent accidental insertion of hands, fingers, or tools.				
Cables	Cables on drill rig are free of kinks, frayed wires, birdcages, flat spots, grease, and worn or missing sections.				
	Cables are terminated at the working end with a proper eye splice; swaged, coupled, or using cable clamps.				
	Cable clamps are installed with the saddle on the live or load side. Clamps are not alternated and are of the correct size and number for the cable size.				
	Wire ropes are not allowed to bend around sharp edges without cushion material.				
Pulleys	Pulleys are not to be bent, cracked, or broken.				
	Pulleys operate smoothly and freely, without resistance.				
Cable Winches	Motor is mounted in correct location and tightly secured to drill rig.				
	Winch is capable of being placed in the free spool (unwind smoothly) and locked position correctly, demonstrating that the cable is suitable for lifting during drilling operations.				
Safety Latches	Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation.				
	Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load.				

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
Flights/Augers	Flights/Augers should not be bent, cracked, or broken. NOTE: Flights/Augers failing inspection must be removed from jobsite.				
	Flights should be blunt to prevent the risks of cuts.				
	Auger keys should not be bent, have any cracks/fractures, be excessively worn, or otherwise damaged.				
	Auger bolt holes and threads should not be damaged.				
	Inspect flights/augers for metal burrs. NOTE: Burrs must be filed to flat surface.				
	Avoid stacking augers; all should lay flat on ground.				
	Avoid manually lifting/moving augers. Should be lifted/moved with cable lines, or, at a minimum, by two persons.				
Drill String	Drill string should not be bent or have any cracks/fractures.				
	Drill string connecting pins should not be bent, have any cracks/fractures, or be excessively worn.				
Mast	Mast is free of bends, cracks, or broken sections.				
	All mounting hardware (pins, bolts, etc.) should be in place.				
	No moving of drill rig while mast is in vertical position.				
	Maintenance/repairs to be performed on mast only in horizontal position.				
Hammering Device	Hammer free of cracks, fatigue, or other signs of excessive wear.				
	Hammer connections are secure.				
Leveling Devices	Outriggers move in/out and up/down smoothly and freely while using controls on drill rig, with no hydraulic leaks.				
	Outriggers are extended prior to and whenever the mast is raised off its cradle. Outriggers must maintain pressure to continuously support and stabilize the drill rig (even while unattended).				
	Outriggers are properly supported on the ground surface to prevent settling into the soil (use of outrigger support pads).				
Controls	Controls are intact, properly labeled, have freedom of movement, and have no loose wiring or connections.				
	Controls are not blocked or locked into an operating position.				
	Installed lights, signals, gauges, and alarms operate properly.				
Lifting Devices	Slings, chokers, and lifting devices are inspected before using and are in proper working order. NOTE: Damaged units are to be labeled and removed from jobsite.				
	Shackles/Clevises are in proper working order with pins/ screws in place that is to be used while lifting.				
	Cables and lifting devices are not operated erratically or with a jerking action to overcome resistance.				
Hydraulic System	Hydraulic lines are secure, in good condition with no signs of excessive wear, and not leaking. NOTE: Check while pressurized.				
	Hydraulic lines are not in a bent or pinched position causing additional fluid restrictions/pressures.				
	Hydraulic oil reservoir has appropriate amount of oil and not leaking.				
	Documentation available to confirm that pressure relief valve was checked during shop maintenance activity and noted on maintenance log.				

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
Pump Lines (water, grout, etc.)	Suction/Discharge hoses, pipes, valves, and fittings are secured and not leaking.				
	High pressure hoses have a safety chain, cable, or strap at each end to prevent whipping in the event of a failure.				
Fire Prevention	A fire extinguisher of appropriate size is located on drill rig and readily available/accessible for drilling crew (recommended 20 lb.).				
	Documentation available to confirm that the drilling crew has received training on proper use of fire extinguishers.				
Ladders	Drill rig has a permanently attached or proper portable ladder to be used for access to drilling platform.				
Tracks	Tracks on rig are not excessively worn and free of any debris or foreign material.				
General	Drill rig meets regulations for transport on state/federal highways (inspection sticker, license plate, etc.).				
	Documentation available to verify that rig was inspected prior to arriving at site.				
	Does the rig size meet job requirements?				
	Maintenance log available for previous 3 months to confirm proper maintenance/inspection.				
Exhaust	Exhaust system should be free from defect and routes engine exhaust away from drill rig workers.				
Fuels	Fuel stored in an approved and properly labeled container.				
	Fuel transfer lines free from signs of excessive wear and not leaking.				
	Refueling and transferring of fuel is performed in an approved area with sufficient containment to prevent spillage.				
Exclusion/ Work Zones	The exclusion/work zone is centered over the borehole and the radius equal to or greater than the height of the mast (measured from ground level).				
	The exclusion/work zone should be clear of tripping hazards.				
Overhead Obstructions	Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to under, by, or near power lines in accordance with the following: * 50 KV or less - minimum clearance of 10 feet * 50 KV or greater - add 0.4 inches for every KV over 50 KV * If voltage is unknown, maintain at least 20 feet of clearance.				
	While the rig is in transit, clearance from energized power lines will be maintained as follows: * Less than 50 KV - 4 feet * 50 thru 365 KV - 10 feet * 366 thru 720 KV - 16 feet				
Rig Repairs	Repairs, when possible, are conducted offsite to reduce the risk of any onsite incidents.				
Specialized PPE	When working at elevated heights, workers are to wear a fall restraining device attached in a manner to restrict fall to less than six feet.				
	When working in wet/slippery conditions, all workers have a lug-type sole or similar slip resistant sole, on their safety footwear to prevent slipping.				

RECOMMENDED SPARE PARTS OR ITEMS TO BE SENT WITH DRILL CREW

DRILL RIG		DPT RIG	
	Emergency Switch		Emergency Switch
	Drive Coupling		Drive Caps
	Shear pins/keys (for drive coupling)		Cutter Head
	Pump Packing		Pull Cap
	Pump Hoses		Liner Cutter
	Auger Bolts		Rod to Cap Pins
	Rod to cap pins		Liner Holder (used while cutting)
	Cutter Head		Spill Kit (5 gal. Bucket with oil dry and absorbent pads)
	Safety Latches, Hooks, Clamps		
	Split Spoon Cutter Head		
	Spill Kit (5 gal. bucket with oil dry and absorbent pads)		

ATTACHMENT 3 BOREHOLE CLEARANCE REVIEW

Site: _____ Project/WO #: _____

Date: _____

Clearance Inspected by: _____ Reviewed by: _____

Yes	No	
<input type="checkbox"/>	<input type="checkbox"/> 1.	Is a scaled site plan showing the proposed borehole locations attached to this form?
<input type="checkbox"/>	<input type="checkbox"/>	2. Are all of the proposed borehole locations at least 3 feet (or farther as dictated by utility owners and regulation) from any subsurface utilities plans?
<input type="checkbox"/>	<input type="checkbox"/>	3. Are all of the proposed borehole locations at least 3 feet from any subsurface utilities shown on public right-of-way street improvement plans? PM to check here <input type="checkbox"/> if applicable to this job.
<input type="checkbox"/>	<input type="checkbox"/>	4. Does the Facility Manager or on-site representative have any knowledge of any subsurface utilities within 3 feet of the proposed borehole locations? (Review locations with the facility manager or client contact as appropriate).
<input type="checkbox"/>	<input type="checkbox"/>	5. Are all of the proposed borehole locations at least 3 feet from any subsurface utilities identified during a geophysical survey if one was conducted? PM to check here <input type="checkbox"/> if applicable to this job.
<input type="checkbox"/>	<input type="checkbox"/>	6. Have all underground service alert providers (One-Call) marked out their facilities in the vicinity of the borehole locations?
<input type="checkbox"/>	<input type="checkbox"/>	7. Do any of the proposed borehole locations lie on a line connecting two similar looking manhole covers or other utility structures?
<input type="checkbox"/>	<input type="checkbox"/>	8. Do any of the proposed borehole locations lie on a line perpendicular to the street from the water, gas, phone, or electrical service drops or meters?
<input type="checkbox"/>	<input type="checkbox"/>	9. Has the pavement in the vicinity of any of the proposed borehole locations subsided or does it give the appearance it may be covering a former trench?
<input type="checkbox"/>	<input type="checkbox"/>	10. Have you hand augured or post-hole dug a hole or otherwise cleared this location (vacuum excavated, pot holed) to 6 feet below grade before using the drill rig?
<input type="checkbox"/>	<input type="checkbox"/>	11. Is the diameter of the hand augured or post hole greater than the outer diameter of the drilling auger or tools you will be using?
<input type="checkbox"/>	<input type="checkbox"/>	12. Is the soil you encountered in the hand augured or post hole clean gravel, clean sand, aggregate base (gravelly sand with ~10% fines), or non-native looking material? Were there any utility tape or markers found in the clearance hole?

Questions 1 thru 9 must be answered prior to mobilizing a drilling rig to the site. Questions 10 thru 12 should be answered prior to drilling by the field staff. **DO NOT DRILL**, if you answered NO to questions 1, 2, 3, 5, 6, 10, or 11 or answered YES to questions 4, 7, 8, 9, or 12. Contact your supervisor for instructions and describe the conflict on the back of this form.

Borehole Clearance Guidance

Introduction:

This brief has been developed to assist teams in the process of clearing boring, drilling, probing, or excavating locations prior to initiating the work. For the sake of simplicity and clarity, the term *boring* shall be synonymous with all intrusive work activities, including but not limited to; drilling, probing, auguring, coring, boring, and excavating. It must be understood that subsurface investigation work presents a unique set of challenges and hazards, and it is up to the *entire project team* to fully and properly evaluate the specific circumstances of every boring location prior to initiating the work. The attached check list will help summarize some of the most important parts of what is discussed below.

One-Call:

Teams must check their specific state and local regulations, as well as, any site or client specific underground utility clearance procedures.

Clearance

For the purpose of this brief, clearance means determining if a boring location is safe to advance based on several factors. These factors include:

- ⌘ The presence of overhead or underground utility structures
- ⌘ The proximity of the boring to other structures (buildings, roads, infrastructure)
- ⌘ The slope of the terrain
- ⌘ Other physical, chemical, biological, and environmental factors

As you can see there are many factors that need to be considered when clearing a location for boring work. A thorough planning session is required to assure that the hazards have been identified and can be controlled prior to advancing borings. The clearance of borings is an ongoing process from initial clearance throughout the implementation phase integrating observations and feedback during the project life cycle. A closer look at hazards follows.

Hazard Recognition, Assessment & Monitoring

Before we can begin to look at the types of hazards we can reasonably expect to encounter during boring work, we must recognize that clearing a boring location is *one step in a much larger process* that continues throughout the implementation phase of the work. Furthermore, on sites where multiple borings or excavations are to be advanced, information gained about the accuracy of utility mark-outs and expectations about subsurface conditions must be refined based on observations and feedback. All too often teams are content when the initial location clearance is completed, forget to revisit this task based on what is confirmed at other locations. A brief discussion of types of hazards we expect to encounter when advancing borings follows:

Physical Hazards: The equipment typically used to advance borings is by design heavy and robust. Because we expect to encounter dense materials like asphalt, concrete, glacial till and rock, the tools and

equipment are heavy and durable enough to cut into and through these materials without breaking. That means moving and operating these tools and equipment presents physical hazards associated with lifting, handling, positioning and operating. Care must be taken not to get caught under, or in between these heavy objects.

The locations where borings are advanced are sometimes on sloped surfaces, have overhead or underground obstructions, or may be in tight or tough to get to positions next to or inside of buildings or structures. Care must be taken in getting the equipment into position without exposing the people to contact hazards. Care must be taken to protect existing structures from damage. Care must be taken to protect personnel and equipment from exposure to traffic hazards.

Once the equipment is in place and operating there is typically hazardous levels of noise generated by the equipment so hearing protection is a must. This equipment typically vibrates during operation so it may shift or move while operating. If the equipment is on jacks, blocks or cribbing to level it that structure may become unstable because of the vibration.

During equipment operation there is to possibility that teams may drill, or bore into pressurized or energized utility structures. This is discussed in FLD-34. The equipment itself may have pressurized hydraulic and pneumatic lines as well as rotating, moving or sliding parts. We need to rely on the training knowledge and experience of the boring contractors to keep us aware and protected from these hazards.

Since many boring operations are conducted year round and outside other physical hazards include heat and cold stress.

Chemical hazards: Exposure to chemical hazards during boring operations may result from drilling into impacted materials, utility or product line damage, exposure to fumes or vapors from the boring and/or the equipments engine, and finally from exposure to materials and fluids within the boring equipment (fuels, oils, coolants, lubricants, etc.) Additional chemical hazards may be present from the cleaning and decontamination of boring tools and equipment and the chemicals used to preserve environmental samples (acids).

Biological hazards: The potential for exposure to biological hazards while conducting borings may exist from contact with injurious plants, animals and organisms (ticks, bacteria, microbes) within the work space or within the boring's cuttings. For this reason skin contact with soiled tools and equipment should be avoided. This topic is discussed further in FLD-43

Radiological hazards: The probability of exposure to non-ionizing radiation during boring is likely since most boring operations are conducted outside. However, during the planning and initial clearance evaluation historical site activities as well as conceptual site models for the project site must be evaluated for the likely hood of exposure to ionizing radiation as well.

The very nature of boring operations lends to a large number of potential exposures to hazards of varying type and magnitude, but by and large the potential for exposure to physical hazards are the most prevalent. Do not disregard the possibility of the potential for exposure to chemical, biological, or radiological hazards, but certainly do not under estimate the probability of exposure to physical hazards.

Implementation

Personnel advancing borings, and supervisors of boring teams, need to be vigilant with regard to monitoring the conditions observed at the boring location and comparing the expected conditions with the observed conditions. These conditions include:

- Æ The types of materials (sand, clay, stone, concrete, etc.),
- æ The expected depths of these materials,
- æ The expected difficulty or ease of penetration into these materials.

The team needs to have a focus and awareness for precursor and indicators, i.e., any unusual and unexpected situations that occur during the boring work. These observations must be communicated throughout the team so that individuals with unique experience in these situations become aware and can recognize any potential hazards before there are exposures to these hazards. Early hazard awareness and communication are critical components to successful clearance and implementation of boring programs.

The important item to remember here is that things are not always as they appear and there is no substitute for experience, or common sense. Remember to look critically at the facts and keep an open mind.

Conclusion

As mentioned earlier the act of clearing a boring location is the first step in a larger process and observations and feedback must be incorporated into that process as it develops and matures. Please take the time to familiarize yourself with the associated FLDs and work closely with team members to take advantage of their unique knowledge and experience.